REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	01/00/89	

4. TITLE AND SUBTITLE
DRAFT FINAL DECISION DOCUMENT FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND TREATMENT SYSTEM, INTERIM RESPONSE ACTION AT THE ROCKY MOUNTAIN ARSENAL

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
ROCKY MOUNTAIN ARSENAL (CO.). PMRMA
COMMERCE CITY, CO

8. PERFORMING ORGANIZATION REPORT NUMBER
89032R02A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THIS INTERIM RESPONSE ACTION CONSISTS OF THE DESIGN AND CONSTRUCTION OF AN ALLUVIAL GROUND WATER INTERCEPT AND TREATMENT SYSTEM IN THE BASIN A NECK AREA.

THIS DRAFT FINAL DECISION DOCUMENT PROVIDES SUMMARIES OF:

1. ALTERNATIVES CONSIDERED
2. SIGNIFICANT EVENTS LEADING TO THE INITIATION OF THE IRA
3. THE IRA PROJECT
4. THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS, CRITERIA, OR LIMITATIONS (ARAR'S) ASSOCIATED WITH THE PROGRAM.

THE RECOMMENDED INTERCEPT METHOD IS A SYSTEM CONSISTING OF:

1. ALLUVIAL GROUND WATER EXTRACTION
2. WATER TREATMENT - ACTIVATED CARBON ADSORPTION PRECEDED BY PACKED COLUMN AIR STRIPPING
3. RECHARGE PROCESSES.

14. SUBJECT TERMS
ARARS, IRA E, HEALTH AND SAFETY

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

89032R02A

DRAFT FINAL DECISION DOCUMENT FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND TREATMENT SYSTEM INTERIM RESPONSE ACTION AT THE ROCKY MOUNTAIN ARSENAL

JANUARY 1989

PREPARED FOR:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

TABLE OF CONTENTS

LIST OF FIGURES

DRAFT FINAL DECISION DOCUMENT
FOR THE BASIN A NECK GROUNDWATER INTERCEPT
AND TREATMENT SYSTEM INTERIM RESPONSE
ACTION AT THE ROCKY MOUNTAIN ARSENAL

1.0 INTRODUCTION

The Interim Response Action (IRA) for the Basin A Neck Groundwater Intercept and Treatment System at Rocky Mountain Arsenal (RMA) is being conducted as part of the IRA Process for RMA in accordance with the June 5, 1987 report to the court in United States v. Shell Oil Co. (Shell) and the proposed Modified Consent Decree dated June 7, 1988.

This IRA project consists of design and construction of an alluvial groundwater intercept and treatment system in the Basin A Neck area on the RMA.

2.0 HISTORY OF RMA BASIN A NECK

Rocky Mountain Arsenal occupies over 17,000 acres, approximately 27 square miles, in Adams County, directly northeast of metropolitan Denver, Colorado (see Figure 1). The property was purchased by the government in 1942 for use in World War II to manufacture and assemble chemical warfare materials, such as mustard and lewisite, and incendiary munitions. Starting in the 1950's, RMA produced the nerve agent GB (isopropyl methylphosphonofluoridate) until late 1969. A significant amount of destruction of chemical warfare materials took place during the 1950's and 1960's. Since 1970, RMA has primarily been involved with the destruction of chemical warfare materials. In addition to these military activities, major portions of the plant facilities were leased to private industries (including Shell Chemical Co.) beginning in 1947 for the manufacture of various insecticides and herbicides.

During the 1940's and 1950's aqueous industrial wastes generated at both the North Plants Area and the South Plants Area were routinely discharged into several unlined evaporation ponds (labeled Basins A, B, C, D, and E) located in the center of the installation. (Figure 2 shows locations of these unlined evaporation ponds, the North Plants Area, and the South Plants Area). Groundwater contamination was first suspected in the mid 1950's when minor crop damage occurred on land north and northwest of the Arsenal. Alluvial groundwater beneath RMA generally flows from southeast to northwest. Concern regarding contaminants in the groundwater led to the design of an asphalt lined basin, Basin F, constructed in 1956. At that time aqueous wastes in Basin A were transferred to Basin F and aqueous wastes produced thereafter were discharged directly to Basin F. Solid wastes were routinely disposed of in trenches and pits located adjacent to Basin A and the Plants Areas.

In the mid 1970's two organic compounds, diisopropylmethylphosphonate (DIMP) and dicyclopentadiene (DCPD) were identified in groundwater off the installation.

A contamination control program at RMA was established to ensure compliance with Federal and State environmental laws. Basin A was identified through the contamination control program as a source area for groundwater contamination at RMA. Groundwater in the alluvial aquifer in the Basin A area has been determined to be contaminated with chemicals from disposal sites, sewers, test sites, storage pits, pools and other sources in the Basin A/Section 36 area. In addition, it has been determined that some of the contaminated groundwater in the South Plants Area flows into the Basin A alluvium. The primary conduit facilitating migration of contaminated groundwater out of Basin A has been identified as the Basin A Neck.

In December 1982, a Memorandum of Agreement (MOA) was entered into by the Colorado Department of Health, the U.S. Environmental Protection Agency, Shell Chemical Company, and the Army. The MOA initiated a cooperative development plan for a comprehensive remedy for the environmental situation at RMA.

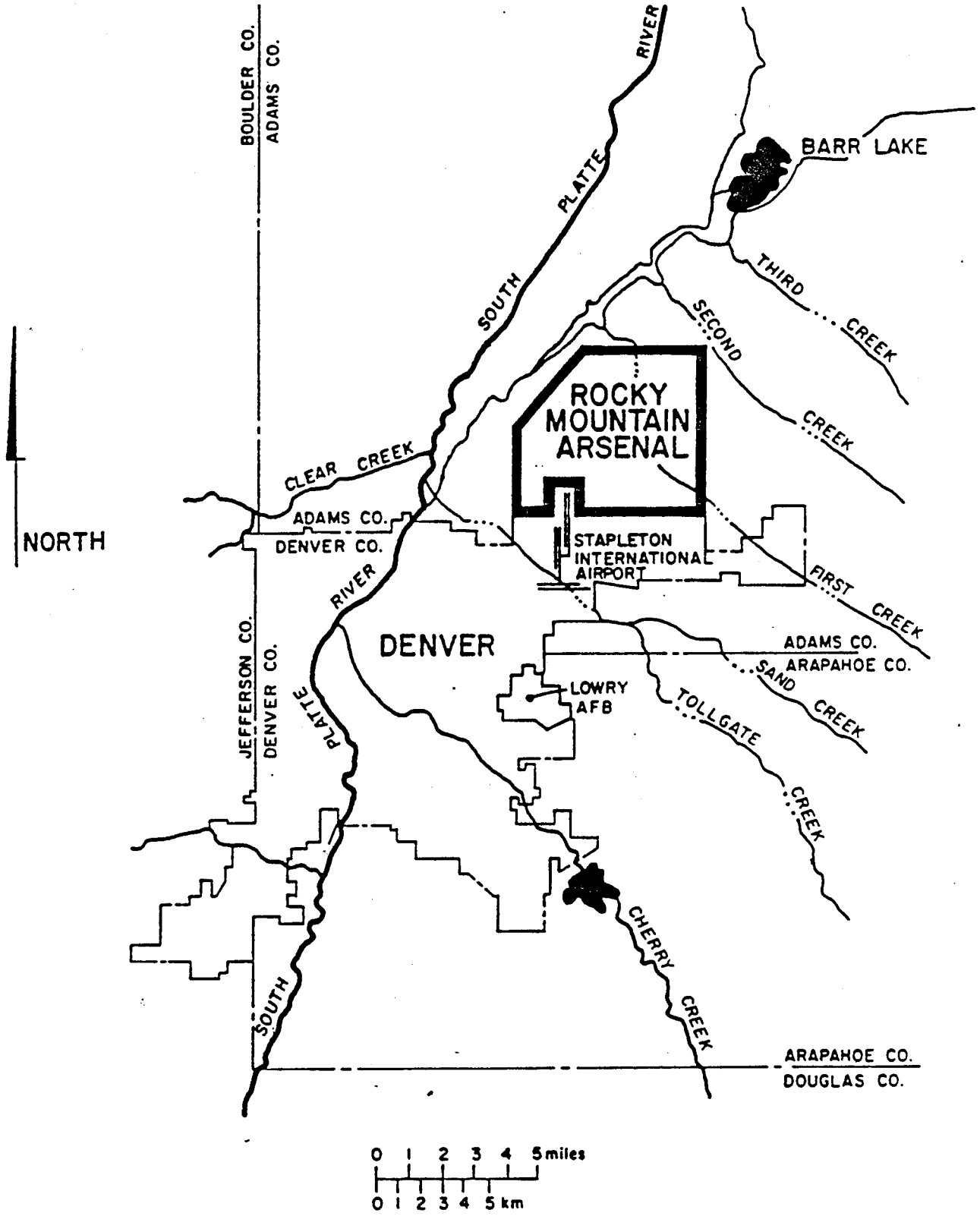
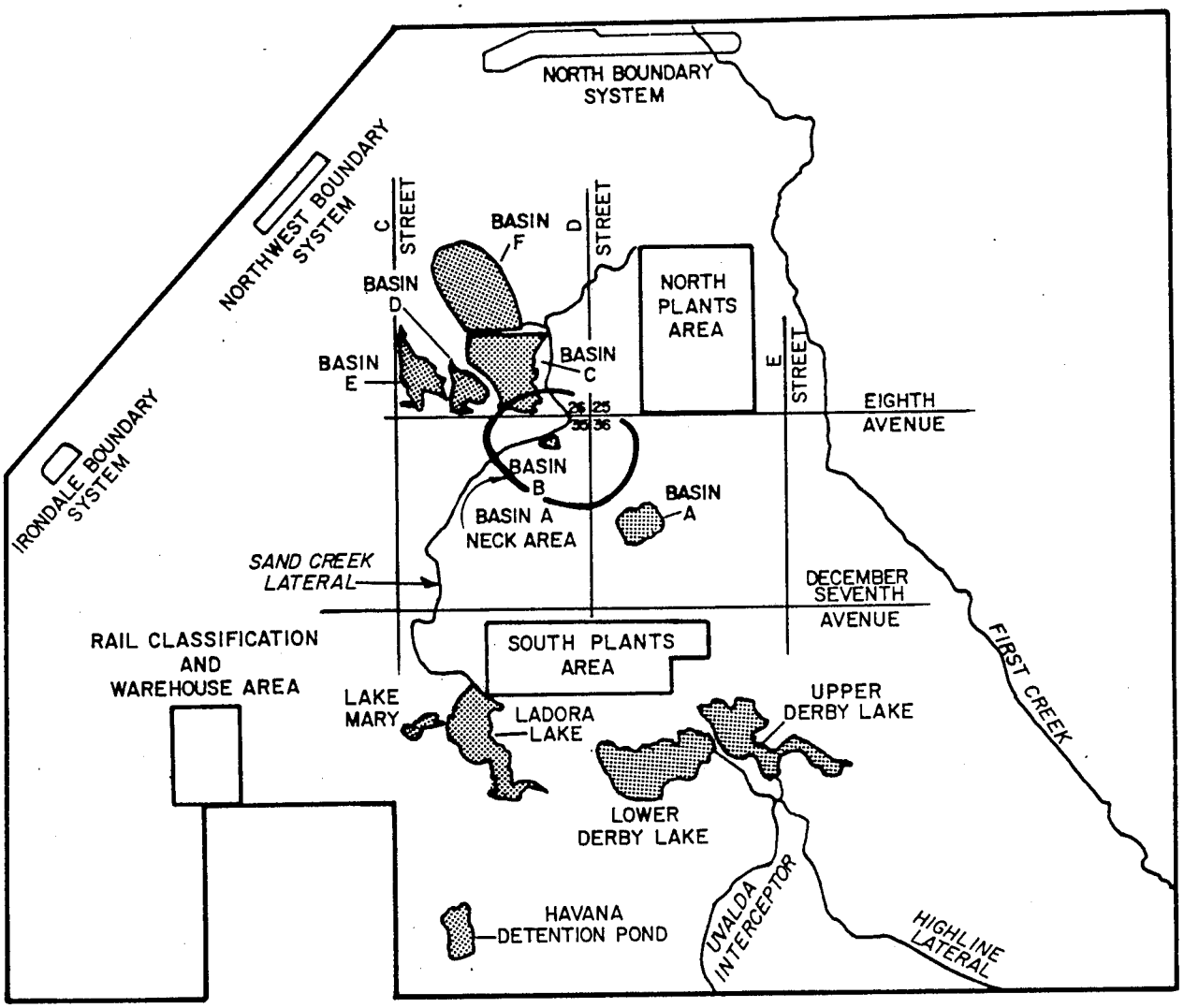


FIGURE 1

LOCATION MAP ROCKY MOUNTAIN ARSENAL

Source: MKE (1988)



Rocky Mountain Arsenal

Figure 2.

Basin A Neck
Location Map

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
1700 Broadway, Suite 1600
Denver, Colorado 80290

Source: MKE (1988).

On February 1,1988, a proposed Consent Decree was lodged in the case of U.S. v. Shell Oil Company with the U.S. District Court in Denver, Colorado. The Proposed Consent Decree was revised after pubic comments were received, and a Modified Proposed Consent Decree was lodged with the Court on June 7, 1988. The Army and Shell Oil Company agreed to share certain costs of the remediation to be developed and performed under the oversight of the U.S. Environmental Protection Agency, with opportunities for participation by the State of Colorado. The long term remediation is a complex task that will take several years to complete. The proposed Consent Decree specifies thirteen Interim Response Actions determined to be necessary and appropriate. The Basin A Neck Groundwater Intercept and Treatment System is one of the thirteen.

2.1 DESCRIPTION OF THE BASIN A NECK

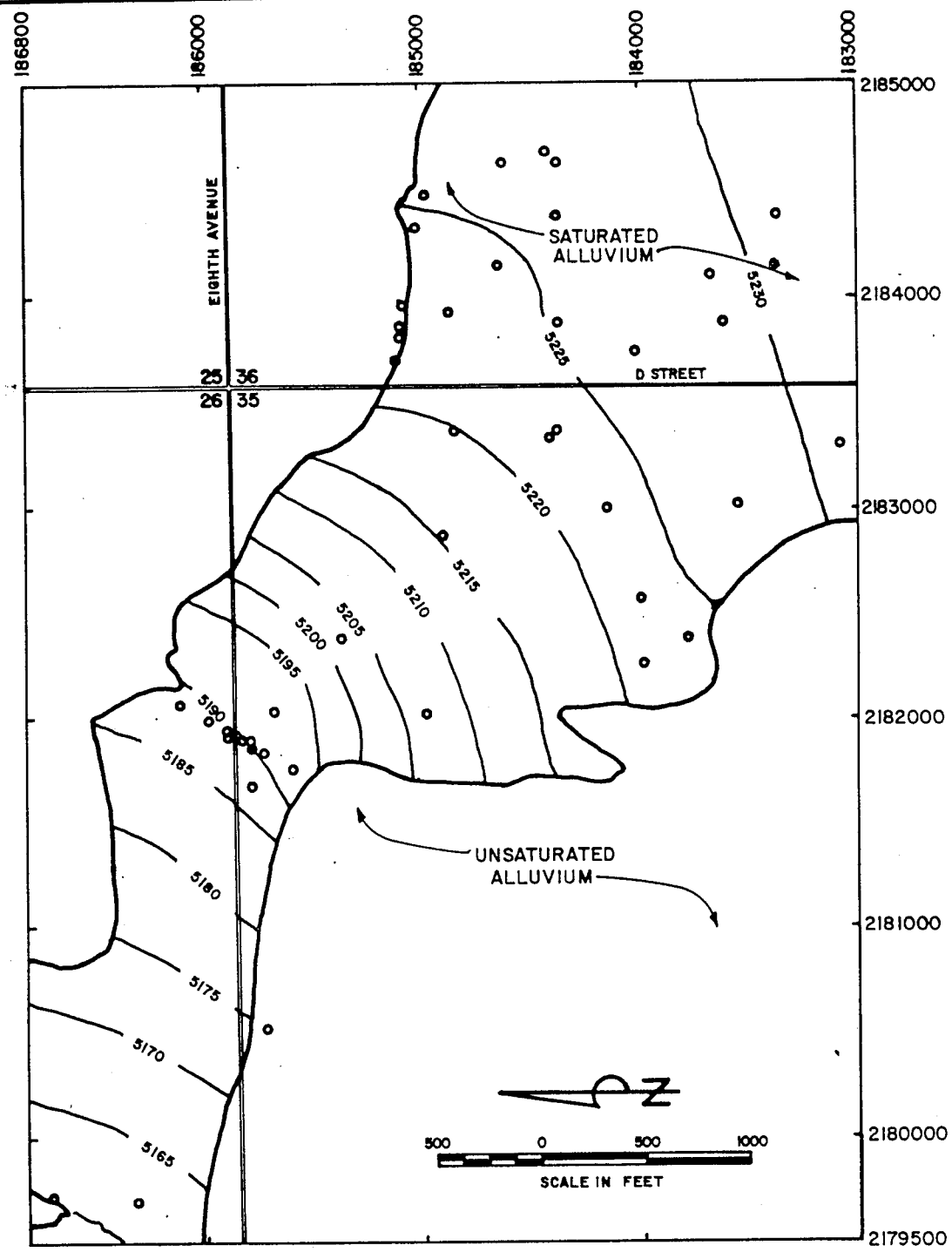
The Basin A Neck forms an alluvial outlet for Basin A groundwater. At the present time, the Basin A Neck is the only connection for which data exist to show significant migration of contaminated flow out of Basin A. As a result, the Basin A Neck was selected for implementation of an IRA to intercept this migration. Whether or not other pathways exist will be investigated in the On-Post Remedial Investigation/Feasibility Study (RI/FS) process and, if necessary, dealt with as part of the final remediation.

The regional, Basin A, and Basin A Neck hydrogeologic conditions at the Rocky Mountain Arsenal have been discussed in previous reports (May et al., 1983; and May, 1982) and consequently will not be discussed in detail in this Decision Document. The hydrogeology of the Basin A Neck Area was discussed in some detail in the Basin A Neck Groundwater Intercept and Treatment System Interim Response Action Alternatives Assessment (Ebasco Services, Inc., 1988). Some data have since been obtained that provide additional hydrogeologic information in the Neck area. These data are presented in a report by Morrison-Knudsen Engineers, Inc. (MKE, 1988). The following brief description of Basin A Neck hydrogeology reflects these recently acquired data.

The Basin A Neck is a northwest-southeast trending erosional valley carved in the surface of the Denver Formation in the northwestern portion of Section 36, the northeastern quarter of Section 35, and the extreme southern portion of Section 26. The valley has been partially filled with alluvial sediments. Denver Formation sediments are exposed on the surface at topographic highs that border the Basin A Neck to the southwest and to the northeast, but bedrock is otherwise blanketed by alluvium. The Denver Formation underlying the alluvium in the Basin A Neck Area consists of shale, mudstone, siltstone, sandstone, and lignitic to sub-bituminous coal.

Figure 3 shows the water table in the Neck as constructed from water table measurements taken during August of 1988. As shown in Figure 3, the water table gradient within the Neck varies from roughly 0.004 to about 0.022 ft/ft. The latest revision of the bedrock surface map, incorporating data obtained from drilling during the summer of 1988, is shown in Figure 4.

Hydrogeologically, the Basin A Neck consists of saturated alluvial material that links the alluvial aquifer beneath Basin A with the saturated alluvium northwest of the Neck. By subtracting the bedrock surface



Data Collected Aug. 8 - 11, 1988

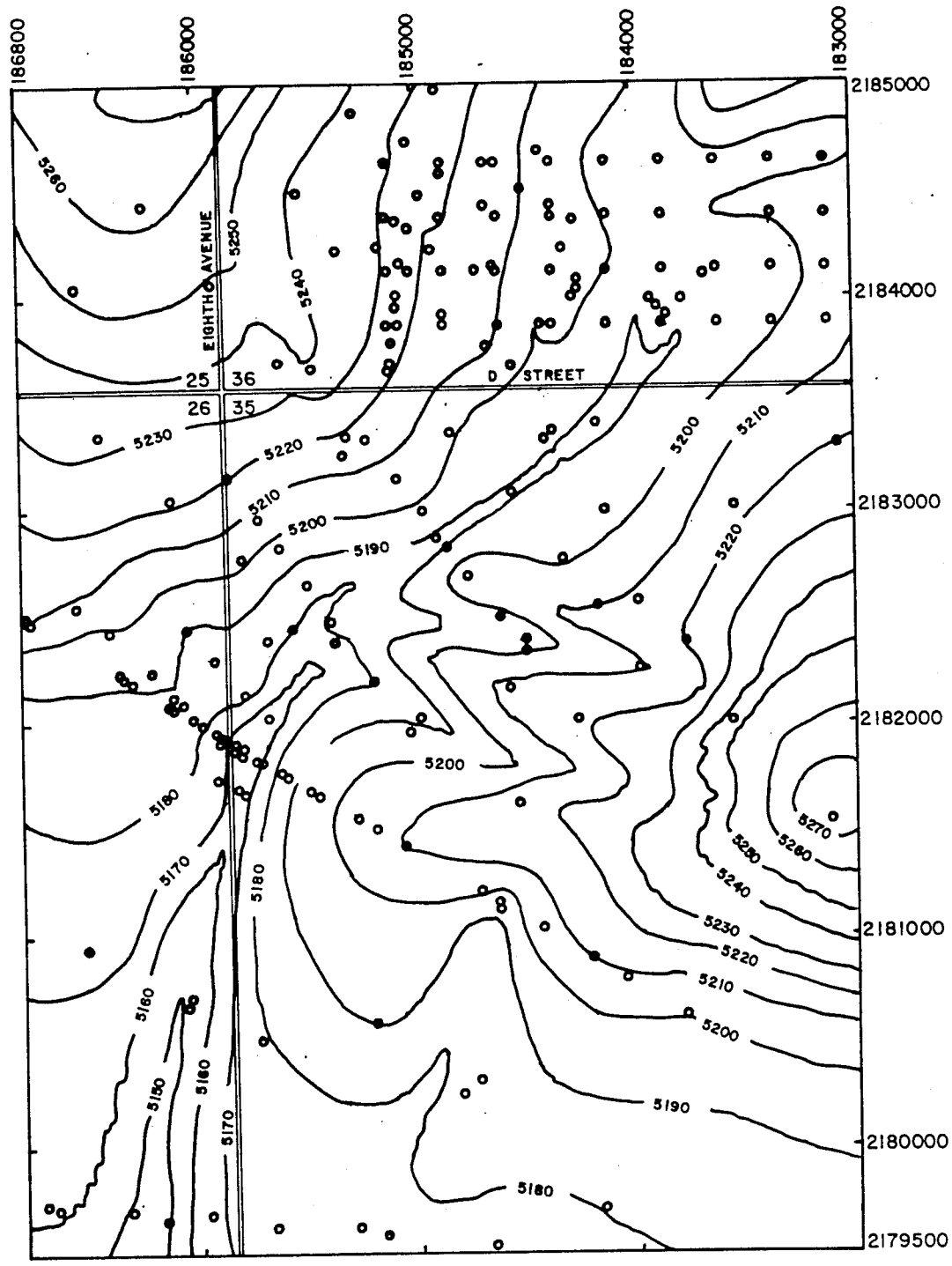
o Data Points Used to Plot Water Table Surface

Source: MKE (1988)

Rocky Mountain Arsenal

Figure 3.
Alluvial Water Table
in the
Basin A Neck Area

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
1700 Broadway, Suite 1600
Denver, Colorado 80290



o Data Points Used to Contour Bedrock Surface

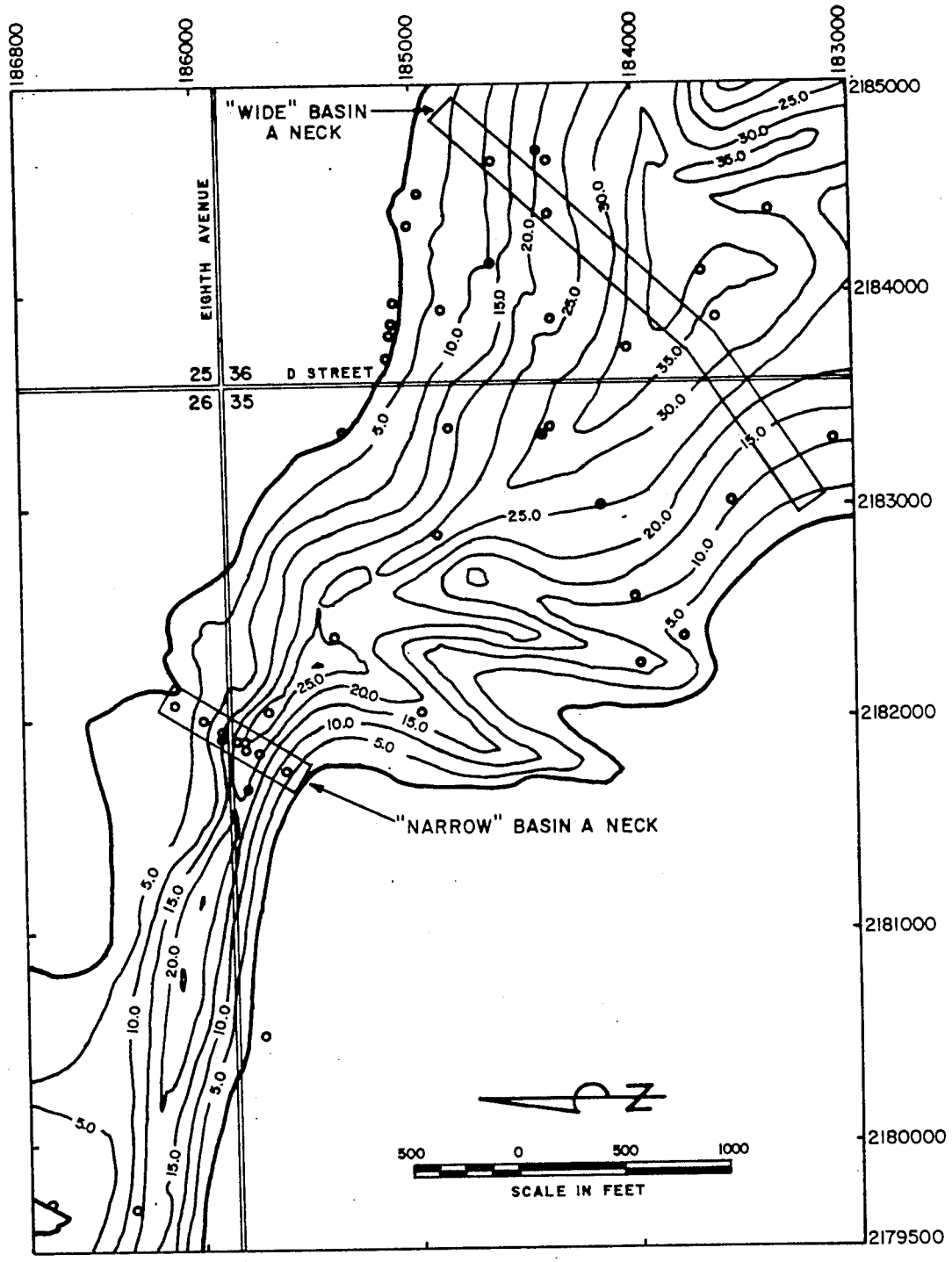
Rocky Mountain Arsenal

Figure 4.

Bedrock Surface in the Basin A Neck Area

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
1700 Broadway, Suite 1600
Denver, Colorado 80290

Source: MKE (1988)



Based on August 8-11, 1988
Water Level Measurements

o Water Level Data Points Used in Contouring Saturated Alluvial Thickness

Rocky Mountain Arsenal

Figure 5.
Saturated Alluvial Thickness
in the
Basin A Neck Area

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON KNUDSEN COMPANY
1700 Broadway, Suite 1600
Denver, Colorado 80290

Source: MKE (1988)

elevations in Figure 4 from the water table elevations in Figure 3, Figure 5 was produced showing the estimated saturated alluvial thicknesses in the Basin A Neck Area. As shown in Figure 5, the thickness of the saturated alluvium in the Neck area varies from 0 to more than 35 feet, and the width varies from about 800 feet in the narrowest section to about 2,800 feet in the wide section.

There is some uncertainty in the configuration of the saturated alluvium downstream from the narrow Basin A Neck in Section 35, but recent mapping by both ESE (Ebasco Services, Inc., 1988) and MKE (1988) shows the principal alluvial channel as turning west towards the Northwest Boundary Containment System.

Two sites, shown on Figure 5, were identified in the Alternatives Assessment (Ebasco Services, Inc., 1988) as potential locations for a groundwater intercept system. The site in the narrowest portion of the Basin A Neck was termed the narrow Basin A Neck location and the site at the head of the Basin A Neck was termed the wide Basin A Neck location.

The geology of the surficial deposits in the Basin A Neck Area is comprised of a variety of soil types and eolian and alluvial sediments. The saturated alluvium in the area of the Basin A Neck is composed primarily of sand, silt, and clay materials, with gravel also being noted in the narrow Neck. Aquifer tests and lithologic logs from recently drilled wells in the narrow neck have shown the presence of a relatively permeable aquifer about 300 feet wide and up to several feet thick roughly centered in the deepest portion of the narrow Neck. Based on the lithologic logs and the aquifer tests, it appears that the permeability in the center portion of the narrow Neck is significantly higher than the permeability further upstream in the wider portions of the Neck. The recently conducted aquifer tests have indicated the hydraulic conductivity of this zone to be about 3.75×10^{-2} cm/sec. As reported in the Alternatives Assessment, a pumping test conducted in Well 36123 in Section 36 near Basin A yielded an estimated hydraulic conductivity of about 3.1×10^{-3} cm/sec (May, 1982).

An estimate of the groundwater flowing through the wide Basin A Neck can be obtained by applying Darcy's Law. As presented in the Alternatives Assessment (Ebasco Services Inc., 1988), an estimated hydraulic conductivity of 3.1×10^{-3} cm/sec, an estimated hydraulic gradient of 0.006 ft/ft, and a saturated cross-sectional area of 51,500 square feet of sandy units below the water table result in an estimated flow through the wide Basin A Neck of approximately 14 gallons per minute (gpm). If the probably more accurate gradient measured on Figure 3 (0.0045 ft/sec in the vicinity of the pumping test in Well 36123) were used, the estimated flow rate would be 11 gpm.

Recent drilling and aquifer tests in the narrow Basin A Neck have been used to provide an estimate of flow thorough the area. The narrow Neck was divided into four hydrologic zones having cross-sectional areas of approximately 1485, 4750, 1560, and 1110 ft^2. Hydraulic conductivity estimates of these four zones (based on the four aquifer tests) are 3.75×10^{-2}, 3.55×10^{-3}, 3.0×10^{-5}, and 6.9×10^{-3} cm/sec, respectively. Using Darcy's Law and the local hydraulic gradient of 0.0115 ft/ft (based on recently collected water levels), the estimated total flow through the narrow Neck alluvium is 14 gpm. This compares very favorably with the 11 to 14 gpm estimates of flow through the wide Neck mentioned above.

As described by MKE (1988), water level data in the Denver sand units underlying the Basin A Neck Area have gradients that indicate groundwater is flowing towards the subcrop areas, resulting in small discharges into the alluvium in the narrow Basin A Neck Area.

The Alternatives Assessment referred to the possibility for alluvial groundwater to flow laterally into a Denver sand unit on the north side of the wider portion of the Neck. However, flow estimates in the narrow Neck made possible by recent aquifer tests in the area (discussed above) are very similar to estimates of flow through the wide Neck. In addition, alluvial groundwater contours shown in Figure 3 are shaped so as to indicate that most or all of the groundwater flow is converging towards the narrow Neck, and not being significantly diverted in the area of the Denver sand unit. Still another indication that alluvial groundwater flow into this subcropping sandstone unit is minimal is that Denver Sandstone wells downgradient (towards the north/northwest) of the subcrop area have not shown contamination consistent with the contamination evident in the Basin A Neck alluvium. These consistent indications show that if flows are exiting into the sandstone subcrop, they must be relatively small.

In the past, there had been some speculation of faulting in the Basin A Neck. There is now general agreement among all of the geologic contractors investigating the Basin A Neck Area that recent investigative drilling in the area has not produced any evidence of faulting in or near the Basin A Neck.

2.2 GROUNDWATER QUALITY IN THE BASIN A NECK

The groundwater quality in the Basin A Neck Area was evaluated in Section 4.3 of the Alternatives Assessment for the Basin A Neck groundwater intercept and treatment system (Ebasco Services, Inc., 1988). In summary, two sets of alluvial wells were chosen as characteristic of groundwater flowing through the narrow Neck (16 wells) and wide Neck (18 wells) areas of Basin A. Only data collected since 1978 were reviewed because of differences in analytical procedures before and after 1978. Also, values reported as being below detection limits were eliminated from statistical analyses to minimize skewing of values for range, mean, and median values.

The data as summarized are included on tables 4.3-1 and 4.3-2 of the Alternatives Assessment (Ebasco Services, Inc., 1988). The compounds, elements, water quality parameters, and respective ranges are representative of contaminants and design parameters that can be expected in groundwater from the Basin A Neck Area. However, the values indicated should not be used as the sole analytical basis for design of a treatment system. Additional analytical data have recently been obtained for design purposes from wells located in the groundwater extraction area.

3.0 INTERIM RESPONSE ACTION OBJECTIVES

The specific objectives of the Basin A Neck Groundwater Intercept and Treatment System IRA are to:

- Minimize the spread of contaminated groundwater migrating through the Basin A Neck as soon as practicable;
- Improve the efficiency and efficacy of the boundary treatment system;
- Collect operational data on the interception, treatment and recharge of contaminated groundwater from this area that may be useful in the selection and design of a Final Response Action; and
- Accelerate groundwater remediation within RMA.

Specific criteria considered in order to achieve these objectives include:

- Provide rapid response;
- Use proven technology;
- Compliance with any designated ARARs to the maximum extent practicable;
- Be consistent with and contribute to the efficient performance of Final Response Actions; and
- Use the most cost-effective alternative for attaining the objectives of the IRA.

In addition to the specific criteria, the system should adhere to good engineering practices.

4.0 INTERIM RESPONSE ACTION ALTERNATIVES

Alternatives for the proposed Basin A Neck Groundwater Intercept and Treatment System Interim Response Action were examined in the Alternatives Assessment, (Ebasco Services, Inc., 1988). Normally, alternatives are assessed at the technology level. However, in the case of this IRA, a set of technologies (that is, groundwater interception and treatment) is specified in the Consent Decree (1988). Consequently, it is deemed appropriate to go into greater detail and assess, to the extent feasible, alternative processes or unit operations that make up the chosen technologies. These alternatives were divided into two groups --hydrologic and treatment. Hydrologic alternatives evaluated were further subdivided by function as either being extraction, recharge, or barrier components of the selected IRA technologies.

4.1 HYDROLOGIC ALTERNATIVES

4.1.1 EXTRACTION

Groundwater will be withdrawn from the Basin A Neck alluvium for removal of the contaminants. Two types of groundwater extraction systems, dewatering wells and subsurface drains, were considered.

Dewatering Wells

Groundwater extraction can be achieved with a series of wells. Groundwater would be pumped from the wells to the treatment system. Well spacing, pumping rates, and aquifer characteristics determine the degree of drawdown across the flowpath through the Neck, and therefore determine the effectiveness of groundwater capture. Extraction with wells is a proven methodology that has worked well with groundwater extraction at other Arsenal locations. Based on measured aquifer characteristics in the narrow Neck, wells appear to be a feasible alternative for extraction at that location. Determing appropriate well spacings and pumping rates is an important aspect of system design.

Subsurface Drains

A subsurface drain constructed across the Basin A Neck could effectively intercept migrating groundwater. Drains usually consist of a constructed permeable zone equipped with a means for lowering the water table within the zone. Typically, a trench is constructed that is filled with permeable materials, and in some cases a buried conduit. Water draining into the trench is removed by one or more pumps. Advantages of subsurface drains include their applicability to aquifers having a broad range of permeabilities and their high collection efficiency. A potential disadvantage can be their cost, depending on the required depth and construction difficulty.

Subsurface drains may be a feasible alternative extraction system in the Basin A Neck alluvium. The costs of constructing a drain would depend on the design considerations, as well as on the measures required to handle contaminated soils and groundwater produced during construction. These factors are an important part of design-related evaluations of the extraction system for the Basin A Neck IRA.

4.1.2 RECHARGE ALTERNATIVES

Four methods of groundwater recharge were considered in the Alternatives Assessment (Ebasco Services, Inc., 1988). These were recharge wells, subsurface drains, recharge pits, and leach fields. Recharge operations could be located adjacent to the extraction operations, or at a remote location. These four operations are briefly summarized below.

Recharge Wells

Wells could be used for recharging treated water into the Basin A Neck aquifer downstream of the extraction system. Recharging water through wells is most likely to be practical where deep permeable zones exist that cannot be feasibly recharged by other methods. When practical, other recharge methods are generally preferred over recharge wells because of the high cost, tendency for plugging, and relatively high maintenance costs of recharge wells. Particularly in the silts, clays, and fine sands common through much of the Basin A Neck Area aquifer, recharge wells can be expected to be difficult to keep operating efficiently. In the coarse sand zones discovered in the narrow Neck, wells may be more suitable.

Subsurface Drains

Subsurface drains used for recharge are essentially similar to drains used for extraction discussed above, except that they are used to recharge, rather than collect, groundwater. An advantage of subsurface drains is that they are suitable for creating a groundwater mound that is continuous over the entire length of the drain that would help ensure capture of migrating contaminated groundwater. Another advantage of subsurface drains is that they maximize the contact area of the aquifer surface, thus maximizing the service life and possible recharge rate, while minimizing the amount of required maintenance. Construction costs of subsurface drains can be quite high if the depth is great, or construction is difficult. Because of their effectiveness, subsurface drains used for recharge would be very desirable if they are determined to be economical.

Recharge Pits and Leach Fields

Recharging in shallow pits and shallow leach fields is common, often is very economical, and is generally effective if geological conditions are favorable. The performance of recharge pits and leach fields is largely related to the vertical permeability of the underlying soils. Conditions favoring water infiltration (such as sandy, highly permeable soils and the

absence of low permeability layers that would impede vertical movement) increase the effectiveness and feasibility of recharge pits and leach fields. The permeabilities of the shallow alluvial materials in the Basin A Neck Area are variable, and not well defined. Further characterization of the alluvial materials would be necessary before the suitability of these operations could be fully evaluated.

Recharge pits might need to be protected from freezing, but have the advantage of being easily scraped out for fairly economical maintenance. Evaporation from recharge pits would result in a consumptive use of water that would need to be addressed from a water rights perspective. If constructed deep enough, leach fields can essentially eliminate the problem of evaporation and freezing associated with recharge pits, yet still be fairly economical.

Since the permeable portions of the Basin A Neck aquifer are often overlain by much less permeable materials, it is expected that recharging all of the aquifer flow by the use of recharge pits or leach fields may be difficult. These recharge technologies may, however, be suitable for recharging portions of the flow in some areas. Additional data and design considerations must be evaluated before such systems could be recommended.

4.1.3 BARRIERS

Groundwater flow can be stopped or obstructed by the use of barriers to help contain contaminant migration. A brief discussion of the possible use of hydraulic and physical barriers in the Basin A Neck Intercept System is given below. A more thorough discussion is contained in the Alternatives Assessment (Ebasco Services, Inc., 1988).

Hydraulic Barriers

In a groundwater intercept system, a hydraulic barrier is created by causing the water table to be shaped such that all flowpaths of the contaminated groundwater terminate at the extraction system. This is generally accomplished by recharging treated water downgradient of the extraction system, thus building a groundwater mound that blocks bypass. Hydraulic barriers are successfully used at the Northwest and Irondale boundary containment systems on the RMA.

For the conditions that exist in the Basin A Neck, a hydraulic barrier is well suited to control the migration of contaminants. Appropriate use of the extraction and recharge systems discussed earlier can create a hydraulic barrier. One disadvantage of a hydraulic barrier is that some recycling of treated water between the recharge and extraction systems inevitably occurs. This recycled flow can even be larger than the original flow through the aquifer, depending on the design and operation of the system.

Physical Barriers

Physical barriers can be made from a variety of materials that can be installed below ground to reduce or redirect groundwater flow. A physical barrier can be used in conjunction with a hydraulic barrier by installing it between the recharge and extraction operations. In such cases the barrier would primarily serve to limit the recycling of treated water (thus lowering operation costs), so some leakage around the barrier would generally not pose significant problems, nor would the barrier be subject to significant exposure to contaminated water. In addition to restricting the amount of recycled water, the physical barrier would provide a degree of back-up to the hydraulic barrier in the event of a temporary failure (e.g. electrical power outage, etc.). A physical barrier would likely reduce the construction and operation costs of the extraction, treatment, and recharge portions of the Basin A Neck IRA because of the costs of treating the water that would otherwise be recycled between the recharge and extraction systems.

A physical barrier can also be used in the absence of a hydraulic barrier to inhibit the passage of contaminated water. In such situations, the barrier would be exposed to contaminated water, leakage would be of more concern, and the possible degradation due to this exposure must be considered.

4.2 TREATMENT ALTERNATIVES

As stated in the Alternative Assessment (Ebasco Services, Inc., 1988), inorganic contaminants are not presently treated in the three RMA boundary groundwater intercept/treatment systems. Moreover, the extent, if any, of control of inorganic compounds in groundwater in the Final Remedial Plan is unknown at this time. Therefore, treatment of inorganic compounds are considered as outside the scope of this IRA. Nevertheless, the design should be such that later addition of inorganic treatment processes is feasible. Inorganic contaminants can cause scaling or fouling in equipment treatment processes for removal of organic contaminants. Therefore, it may also become necessary to consider treatment for inorganic contaminants in order to protect organic contaminant removal equipment against fouling or scaling.

A preliminary screening of available organic contaminant treatment technologies has been performed and only the following technologies having documented performance, applicability, and reliability are considered potentially applicable to this IRA.

1. Activated carbon adsorption
2. Air Stripping
3. Biological Treatment
4. Evaporation
5. Oxidation
6. Reverse Osmosis

The following discussion of each technology addresses system operation, required pretreatment, wastestreams generated, reliability, design flexibility, complexity, relative cost, and advantages and disadvantages.

Activated Carbon

Activated carbon adsorption is the most widely developed and used process for removal of organic contaminants from water and involves passing the contaminated water through a bed of activated carbon to allow the organic compounds to adsorb to the surfaces of the carbon particles. Activated carbon adsorption removes both volatile and non-volatile organic compounds from water. This process has been proven effective in removing the majority of organic contaminants found in the RMA groundwater, except for certain polar compounds such as methylene chloride and chloroform that do not have a great affinity for a nonpolar adsorbent such as carbon.

Activated carbon adsorption is currently used at the RMA North Boundary, Northwest Boundary, and Irondale Boundary containment/treatment systems. Operating histories at these plants indicate very high removal efficiencies for many RMA organic contaminants, including dibromochloropropane (DBCP), diisopropylmethyl phosphonate (DIMP), and dicyclopentadiene (DCPD).

Activated carbon adsorption design parameters such as adsorption isotherms and empty bed contact times have been developed through pilot testing for the majority of organic compounds encountered at the Basin A Neck. One pilot study, in particular, successfully treated groundwater containing similar compounds in higher concentrations than those expected at the Basin A Neck (Stearns-Roger Engineering Corp., 1983).

The relative advantages and disadvantages of activated carbon adsorption compared to the other treatment processes are as follows:

Advantages

- Extensive experience in utilization of process
- Ability to remove mixtures of volatile and non-volatile organic compounds
- Ease of operation
- Reliability

Disadvantages

- Possible plugging of recharge system (particularly wells) with carbon fines

- Need for carbon replacement or regeneration resulting in relatively high operating costs
- Spent carbon, if not regenerated, may require disposal as a hazardous waste.

Activated carbon adsorption has been proven highly effective in the removal of most organic contaminants encountered at the RMA. As a result, it is included as one of the treatment processes of choice for use in the Basin A Neck IRA.

Air Stripping

Air stripping is an effective and proven method for removal of volatile organic compounds from water. This is accomplished through conversion of the contaminant from a liquid to a gaseous phase by contacting the liquid with air. The removal efficiencies of the compounds are proportional to their relative partial pressures. Air strippers have been used at many sites to effectively remove volatile chlorinated solvents from drinking water supplies.

A packed column type air stripper was evaluated as part of the South Plants groundwater treatment pilot plant and demonstrated removal efficiencies of 96-100% for volatile organic compounds except methylisobutyl ketone (MIBK) and carbon tetrachloride (Stearns-Roger Engineering Corp., 1983). As expected, the non-volatile organic compounds did not exhibit high removal efficiencies.

Off gas from an air stripper contains the organic compounds stripped from the contaminated groundwater. If air emission standards would be exceeded, the exhaust air is normally either incinerated or treated with a vapor phase carbon adsorption unit to remove the contaminants.

The relative advantages and disadvantages of air stripping compared to the other treatment processes are as follows:

Advantages

- Relatively low capital and operating costs
- Ease of operation
- Reduced loading on carbon adsorption beds when used to precede carbon adsorption process

Disadvantages

- Some organic compounds are not removed
- Low removal efficiencies for non-volatile organic compounds

- Contaminated off gas may constitute wastestream requiring treatment and/or disposal

The compounds present in the Basin A Neck Area (based on existing analytical data) that are amenable to effective removal by air stripping include chloroform, methylene chloride, tetrachloroethylene, and trichloroethylene. As indicated previously, the former two compounds are not effectively removed through activated carbon adsorption. However, air stripping and activated carbon adsorption used in combination can achieve a high level of removal of all organic contaminants contained in the Basin A Neck groundwater. Air stripping should remain in consideration as a treatment alternative for use in combination with activated carbon adsorption.

Biological Treatment

Biological treatment removes organic contaminants through microbial assimilation and degradation. Aerobic processes such as activated sludge are most commonly used. The resultant waste activated liquor (excess biomass) from such processes is generally nontoxic.

An activated sludge system was tested by Shell Development Company for treating RMA groundwater (Rezai, 1982). The pilot test results indicated high levels of removal of chloroform, benzene, and dibromochloropropane (DBCP). Biodegradability tests using incubation, on the other hand, showed no biodegradation of aldrin, dieldin, or endrin.

The relative advantages and disadvantages of biological treatment compared to other treatment processes are as follows:

Advantages

- Adaptability of process to a variety of contaminants
- Wastestreams from system are generally non-toxic
- Relatively low capital and operating costs

Disadvantages

- Process has limited efficiency with respect to removal of certain organic compounds
- Extensive process monitoring is required
- Process is subject to upsets by compounds toxic to microorganisms
- Extensive pilot testing is required for design

- Process requires feed stream of relatively constant quantity and quality

Biological treatment systems require the total organic carbon concentration to be fairly constant, a condition that is usually met with groundwater. Also, a minimum total organic carbon (TOC) concentration in the water is needed to sustain the microorganisms. Water quality data indicate that the total organic content in groundwater from the Basin A Neck Area is too low to sustain a sufficient quantity of biomass to make biological treatment feasible (COE, 1987). In addition, not all of the compounds present are readily treatable with biological systems, particularly the pesticides. While treatment of these organics may be feasible, considerable time would be spent in developing and demonstrating an effective biological treatment system. It therefore does not appear that biological treatment would be a viable alternative for the Basin A Neck groundwater and it will not further be considered.

Evaporation

Evaporation is a process by which volatile liquids such as water and certain volatile organic compounds are removed from the wastestream, leaving behind the non-volatile components. Solar evaporation ponds as well as mechanical evaporators can be used to implement this process. Dissolved solids are precipitated through evaporation and would require disposal as a hazardous waste. Water lost through evaporation could be replaced in the aquifer by recharge of purchased water. Only solar evaporators were considered, since mechanical evaporators are cost prohibitive.

The relative advantages and disadvantages of solar evaporation compared to other treatment processes are as follows:

Advantages

- Low operating cost

Disadvantages

- Release of volatiles or odors may exceed regulatory limits
- Residue concentrate/solids would require treatment and disposal as hazardous waste
- Ponds must be designed to limit access by wildlife

A solar evaporation pond to treat the Basin A Neck wastestream would be approximately 0.75 acres in size for each gallon per minute treated (for example, an 11-acre pond would approximately handle a 15 gpm stream). A pond containing hazardous material of this size needed for the Basin A Neck could pose a risk to wildlife and the environment in general.

Evaporation, on the other hand, is a proven and highly effective process for wastestreams containing inorganic contaminants. In the event that

removal of inorganic contaminants becomes a priority, evaporation might become a treatment system of choice and should be reconsidered.

Oxidation

Oxidation involves chemical or thermal destruction of organic compounds. Thermal oxidation normally involves incineration, while chemical oxidation is accomplished using a chemical oxidizing agent such as ozone, hydrogen peroxide, or potassium permanganate. Ultraviolet radiation is often used to catalyze a chemical oxidation process in order to enhance destruction and reduce chemical and contact time requirements.

Laboratory bench scale studies and pilot testing have indicated effective destruction of organic compounds using the UV/ozone process. Operating parameters must be carefully controlled for each target compound in order to achieve total destruction. These parameters include, UV dosage, ozone dosage, pH, detention time, and use of supplemental chemical oxidants.

The relative advantages and disadvantages of oxidation compared to other treatment processes are as follows:

Advantages

- Ability to achieve virtually complete destruction of contaminants
- Produces no residual wastestream requiring further treatment

Disadvantages

- Relatively high capital and operating costs
- Possible fouling of process by inorganic elements and compounds
- Difficulty in process control
- Very poor energy efficiency due to low concentration of organics

Oxidation is a promising technology, but is largely unproven for the mixture of organic compounds encountered in the Basin A Neck. Extensive pilot testing using Basin A Neck groundwater is required to demonstrate feasibility of this treatment process. Additionally, the process requires very high capital and operating expenditures. For these reasons, this process is not selected as a treatment alternative.

Reverse Osmosis

Reverse osmosis is a membrane separation process that reduces concentrations of dissolved organic and inorganic compounds. Pretreatment of

reverse osmosis influent is essential to prevent fouling and plugging of the semipermeable membrane. This process is used mostly to remove inorganic dissolved solids from wastestreams such as in a desalinization process. Very little literature or pilot testing data are available to predict performance of reverse osmosis in removal of organic compounds from the Basin A Neck groundwater.

Wastestreams up to 30 percent as large as the feed stream can be expected from the process, depending on the staging configuration of the system. These wastestreams would contain higher concentrations of the organic contaminants and would require further treatment prior to disposal.

The relative advantages and disadvantages of reverse osmosis compared to other treatment processes are as follows:

Advantages

- o The ability to remove simultaneously inorganic and some organic contaminants

Disadvantages

- o Relatively high capital and operating costs (membranes require replacement every 2-3 years)
- o Membrane susceptibility to fouling and plugging
- o Production of reject stream requiring additional treatment such as evaporation and solids disposal, oxidation, adsorption, or air stripping

Reverse osmosis is a proven technology for removing organics with molecular weights down to about 150 to 200. The organic contaminants in the Basin A Neck groundwater include compounds with molecular weights both above and below this range (COE, 1987). This means that unless they were adsorbed by the membrane, dicyclopentadiene and diisopropylmethyl phosphonate and the lower molecular weight compounds would partition to the permeate, while aldrin and dieldrin would be found in the concentrate. The required removal efficiencies would consequently not be obtained by reverse osmosis for most of the compounds in Basin A Neck groundwater. In addition, extensive pretreatment would be required, pilot studies would be necessary, and capital and operating costs would be very high. Reverse osmosis is consequently eliminated from further consideration.

4.3 NO ACTION ALTERNATIVE

Section IX of the proposed Consent Decree (1988) states that the Basin A Neck Groundwater Intercept and Treatment System IRA has been determined to be both necessary and appropriate. Therefore, this alternative will not be considered.

5.0 CHRONOLOGY OF EVENTS

The significant events leading to the decision to install the groundwater intercept and treatment system described in Section 6.0 are presented below.

Date	Event
June 1987	State of Colorado, Shell Oil Company, U.S. Environmental Protection Agency, and U.S. Army agreed that 13 Interim Response Actions (including Basin A Neck Groundwater Intercept and Treatment System) would be conducted.
August 1987	Completed Basin A Neck Groundwater Recovery and Injection System (Morrison-Knudsen Engineers, Inc., 1987). Described geohydrology of area, and proposed remediation and further investigations at Basin A Neck.
September 1987	Completed Draft Final Task 26 Interim Response Action Assessment Version 1.2 (Ebasco Services, Inc., 1987). Identified and evaluated potential response actions that could be implemented prior to final remedy for RMA. Basin A Neck was the only site of nine sites studied by Task 26 that was determined to be appropriate for an Interim Response Action.
October 23, 1987	Ebasco Services, Inc., commented on Basin A Neck Groundwater Recovery and Injection System Report.
October 27, 1987	Shell Oil Company commented on Task 26 Interim Response Action Assessment Draft Report.
January 26, 1988	State of Colorado commented on Task 26 Interim Response Action Assessment Draft Report.
February 1, 1988	Proposed Consent Decree (1988) lodged in the case of U.S. v. Shell Oil Company with the U.S. District Court in Denver, Colorado. The Court Decree specified thirteen interim action (including Basin A Neck Groundwater Intercept and Treatment System) to facilitate remediation activities.

Date	Event
June 7, 1988	Modified Proposed Consent Decree lodged with the Court, containing revisions based upon public comments.
June 30, 1988	Draft ARARs provided to EPA, Shell Oil Company and the the State of Colorado.
June 30, 1988	Basin A Neck Groundwater Intercept/Treatment System Draft Alternatives Assessment issued.
July 27, 1988	EPA, Region VIII provided comments on Basin A Neck Groundwater Intercept/Treatment System Draft Alternatives Assessment.
July 29, 1988	Shell Oil Company provided comments on Basin A Neck Groundwater Intercept/Treatment System Draft Alternatives Assessment.
July 29, 1988	EPA, Region VIII provided comments on Draft ARARs.
July 29, 1988	State of Colorado provided comments on Draft ARARs.
August 1, 1988	State of Colorado provided comments on Basin A Neck Groundwater Intercept/Treatment System Draft Alternatives Assessment.
August 1, 1988	Shell provided comments on Draft ARARs.
September 22, 1988	Issued Final Basin A Neck Groundwater Intercept and Treatment System Interim Response Action Alternatives Assessment (Ebasco Services, Inc., 1988). Recommended extraction and recharge systems be installed, and possibly used so as to create a hydraulic barrier. Recommended a groundwater treatment system be constructed composed of activated carbon adsorption units and post treatment filtration.

6.0 SUMMARY OF THE INTERIM RESPONSE ACTION PROJECT

The goal of early implementation tends to favor the selection of technologies/processes with demonstrated effectiveness in situations similar to those at the Basin A Neck (i.e., similar contaminants, hydrology, etc.) and which can be implemented without undue delay. It is expected also that certain aspects of the Basin A Neck system design will be based on only limited data input necessary in the interest of expediting implementation. It is believed, however, that the benefit of early implementation will more than offset possible adverse effects of limited data. Typically, groundwater extraction/treatment systems consist of simple, repetitive components and thus are highly amenable to modifications/adjustments which further studies may suggest to improve system performance or to meet redefined goals (for example, from the On-Post RI/FS).

The Basin A Neck Groundwater Intercept and Treatment System Interim Response Action consists of alluvial groundwater extraction, water treatment, and recharge processes in the Basin A Neck area. Designing the system so as to create a hydraulic barrier is recommended. It is recommended that the system be constructed in the narrow Neck, approximately as identified on Figure 5. The reasons for selecting this location include: 1) the location is downstream of some known and some potential contaminant sources that are located between the wide and narrow Necks, 2) the narrow Neck location is downstream of a large quantity of contaminated groundwater located between the wide and narrow Neck locations that would not be intercepted by a system in the wide Neck, 3) the narrow Neck location will allow interception of groundwater flowing from the Denver Formation sands into the alluvium between the two locations, 4) the relatively higher hydraulic conductivity of the narrow Neck aquifer is more conducive to constructing effective extraction and recharge facilities, and 5) the constriction afforded by the narrow Neck provides a relatively economical location to intercept the contaminated flow emanating from the Basin A alluvial aquifer.

6.1 HYDROLOGY

Based on data recently obtained, economic and hydraulic analyses have been performed so that the extraction and recharge processes may be selected. Based on these analyses, recharge trenches appear preferable for the recharge process. It is recommended that extraction be performed by the use of wells. Creation of a hydraulic barrier with the recharge system (i.e., a hydraulic mound caused by the recharge trenches) is recommended so as to minimize, if not completely stop, the flow of contaminated groundwater in the alluvium past the intercept system. In addition, construction of a physical barrier between the extraction and recharge systems is also recommended so as to provide some added reliability to the intercept system, and to avoid the much higher capital and operation and maintenance costs associated with handling the significant amount of recycled water that would exist in the absence of a physical barrier.

6.2 TREATMENT

A treatment process involving activated carbon adsorption preceded by packed column air stripping will be utilized to treat the Basin A Neck groundwater. Using recently obtained water quality data, these processes were selected based on their ability to efficiently remove organic contaminants from groundwater and their cost-effectiveness. The following design parameters for the activated carbon and air stripping processes will be investigated during the design phase of the project.

Activated Carbon Adsorption

- o Empty bed contact time
- o Carbon type
- o Mode of operation: upflow or downflow
- o Backwash bed expansion
- o Frequency of carbon regeneration
- o Pretreatment and post-treatment requirements
- o Single, double, or triple staging of exchange vessels
- o Regeneration or exchange of carbon
- o Methodology for extraction of spent carbon
- o Disposition of backwash wastewater

Air Stripping

- o Air to water ratio
- o Column packing type
- o Pretreatment and post-treatment requirements
- o Packing depth
- o Method of air emission control

The selected treatment system will be reliable and capable of consistently achieving high levels of removal for organic compounds. In addition, the system will be flexible and expandable with respect to staging and pre/post-treatment requirements to maximize the potential for compatibility with the system selected for final remediation of the Arsenal. Operation of the system selected for this IRA may provide valuable data that can be used in the selection and design of the Final Remedial Actions.

6.3 HEALTH AND SAFETY PLAN

A Health and Safety Plan has been developed for the prevention of occupational injuries and illnesses during field activities at RMA. This plan addresses health and safety requirements of contractors and their authorized subcontractors. Compliance with this plan will be compulsory and the contractors will be responsible for self-enforcement and compliance with this plan. The Health and Safety Plan was developed with consideration for known hazards as well as potential risks. Comprehensive environmental monitoring and site-specific personal protection are combined in an effort to best protect workers to the maximum extent practicable.

A site specific Health and Safety Plan for work to be performed on the Basin A Neck Groundwater Intercept and Treatment System will be developed and included in the Implementation Document. This site-specific plan will contain specifics of monitoring plans, worker protection and work modifications to be conducted in the event that certain levels of contaminants are detected or if necessary to ensure worker health and safety.

7.0 IRA PROCESS

With respect to this IRA for the Basin A Neck Groundwater Intercept and Treatment System, the IRA process is as follows:

1. The Army prepared a draft Basin A Neck Groundwater Intercept and Treatment System IRA Alternatives Assessment and a draft of the ARARs document that were submitted to the DOI, the State, and the other organizations for review and comment. Comments were to be submitted within 30 days after receipt of the draft assessment. After the close of the comment period, and in consideration of the comments received, the Army prepared and transmitted a final assessment to the DOI, the State, and other organizations.

2. The Army afforded the Department of Interior (DOI), the State, and other organizations an opportunity to participate, at the RMA Committee level, in the identification and selection of ARARs pertinent to this IRA. In this instance, the participation took the form of the Army's submitting an initial draft of this document to the RMA Committee members.

3. This Proposed Decision Document for the Basin A Neck Groundwater Intercept and Treatment System IRA is subject to a 30-day public comment period including a public meeting approximately two weeks into the comment period. This Proposed Decision Document is supported by an administrative record.

4. Promptly after close of the Proposed Decision Document comment period, the Army shall transmit to the DOI, the State, and other organizations a Draft Final Decision Document for the Basin A Neck Groundwater Intercept and Treatment System IRA.

5. Within 20 days after issuance of the Draft Final Decision Document for the Basin A Neck Groundwater Intercept and Treatment System IRA, an organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Consent Decree, or DOI under the circumstances set forth in the Consent Decree) may invoke Dispute Resolution.

6. After the close of the period for invoking Dispute Resolution (if Dispute Resolution is not invoked) or after the completion of Dispute Resolution (if invoked), the Army shall issue a final Decision Document for the Basin A Neck Groundwater Intercept and Treatment System IRA with the supporting administrative record. Thereafter, the Decision Document will be subject to judicial review in accordance with Sections 113 and 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. Sections 9613, 9621.

7. Following issuance of the final IRA Decision Document, Shell shall be the Lead Party responsible for designing and implementing the

IRA in conformance with the Decision Document. Shell shall issue a draft IRA Implementation Document to the DOI, the State, and the other Organizations for review and comment. This draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and IRA Deadlines for implementation of the IRA.

8. If any organization (including the State) or the DOI, believes that the IRA is being designed or implementated in a way that will not meet the objectives for the IRA set forth in the final IRA Decision Document or draft Implementation Document, or is otherwise not being properly implemented, it may so advise the others and shall recommend how the IRA should be properly designed or implemented. Any Organization (including the State, if it has agreed to be bound by the Dispute Resolution process, as required by the Consent Decree, or the DOI under the circumstances defined in the Consent Decree) may invoke Dispute Resolution to resolve the disagreement.

9. As Lead Party for design and implementation of this IRA, Shell will issue the final Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the IRA Implementation Document.

8.0 ARARs

8.1. ATTAINMENT OF ARARs

The interim action process reported to the court on June 5, 1987, in United States v. Shell Oil Co. provides that interim response actions (including this IRA to intercept and treat groundwater in the Basin A Neck) shall, to the maximum extent practicable, attain standards, requirements, criteria, or limitations under any Federal environmental laws (or more stringent promulgated standards, requirements, criteria, or limitations under State Environmental or facility siting law that are legally applicable to the hazardous substance or pollutant or contaminant concerned or relevant and appropriate under the circumstances of the release or threatened release. A similar provision appears in Paragraph 9.7 of the proposed Consent Decree.

8.2 IDENTIFICATION AND SELECTION OF ARARs

By letter dated January 19, 1988, counsel for the Army requested that EPA, Shell and the State preliminarily identify in writing the potential ARARs that they believe may be pertinent to this IRA. No responses were received from EPA, Shell, or the State.

By letter dated June 30, 1988 the Army provided draft ARARs for the Basin A Neck Groundwater Treatment System IRA to EPA, Shell, the State, the U.S. Department of Interior and ATSDR for review and comment. EPA, Shell and the State provided comments concerning these draft ARARs. After review of these comments and modification of these draft ARARs, revised ARARs were included in the proposed Decision Document for further review and comment.

8.3 SELECTION OF ARARs AND DETERMINATION OF ARAR IMPACT

8.3.1 AMBIENT OR CHEMICAL-SPECIFIC ARARs

Ambient or chemical-specific requirements set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants or contaminants. Such ARARs either set protective cleanup levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge.

The purposes of this IRA are stated in Section 3.0 and include to reduce the level of contamination in the groundwater in Basin A Neck, to improve the efficiency and efficacy of treatment by the RMA boundary systems, and to accelerate the remediation of RMA groundwater. This IRA will be implemented prior to the final remediation to be undertaken in the context of the On-Post Operable Unit ROD.

For this IRA, the Army has selected an existing "off-the-shelf" technology for interim remediation of Basin A Neck groundwater, consistent with the IRA emphasis on speed of implementation, which the Army fully

anticipates will also achieve, at the point of reinjection of the treated groundwater, the following identified standards, requirements, criteria or limitations that the Army has selected as relevant and appropriate here for the CERCLA hazardous substances specified below:

(1) Arsenic

(a) CASRN: 7440382
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 50 ug/l.
(Source: 40 C.F.R. Section 141.11(b) (NPDW-MCL) and 40 C.F.R. Section 264.94(a)(2) (RCRA))

(2) Benzene

(a) CASRN: 71432
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 5 ug/l
(Source: 40 C.F.R. Section 141.61(a), 52 Fed Reg. 25716 (1987) (effective Jan. 9, 1989) (NPDW-MCL))

(3) Carbon Tetrachloride

(a) CASRN: 56235
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 5 ug/l.
(Source: 40 C.F.R. Section 141.61(a), 52 Fed Reg. 25716 (1987) (Effective Jan. 9, 1989) (NPDW-MCL))

(4) Chlorobenzene (Monochlorobenzene)

(a) CASRN: 108906
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 488 ug/l.
(Source: 45 Fed. Reg. 79327-79328 (1980) (AWQC-Human Health))

(5) Chloroform

(a) CASRN: 67663
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 100 ug/l.
(Source: 40 C.F.R. Section 141.12 (NPDW-MCL) (Note that this is the total combined limit for this and all other trihalomethanes.))

(6) DDT

(a) CASRN: 50293
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 10 ug/1.
(Source: 40 C.F.R. Section 129.101(a)(3) (TPES))

(7) 1,2-Dichloroethane

(a) CASRN: 107062
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 5 ug/1.
(Source: 40 C.F.R. Section 141.61(a); 52 Fed. Reg. 25716 (1987) (effective Jan. 9, 1989) (NPDW-MCL))

(8) 1,1-Dichloroethylene

(a) CASRN: 75354
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 7 ug/1.
(Source: 40 C.F.R. Section 141.61(a), 52 Fed. Reg. 25716 (1987) (effective Jan. 9, 1989) (NPDW-MCL))

(9) Dieldrin

(a) CASRN: 60571
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 0.12 ug/1.
(Source: 40 C.F.R. Section 129.100(a)(3) (TPES))

(10) Endrin

(a) CASRN: 72208
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 0.2 ug/1.
(Source: 40 C.F.R. Section 141.12 (NPDW-MCL))

(11) Hexachlorocyclopentadiene

(a) CASRN: 77474
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 206 ug/1.
(Source: 45 Fed. Reg. 79336 (1980) (AWQC-Human Health))

(12) Mercury

(a) CASRN: 7439976
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 2 ug/1.
(Source: 40 C.F.R. Section 141.11(b) (NPDW-MCL) and 40 C.F.R. Section 264.94(a)(2) (RCRA))

(13) 1,1,1-Trichloroethane

(a) CASRN: 71556
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 200 ug/1.
(Source: 40 C.F.R. Section 141.61(a); 52 Fed. Reg. 25716 (1987) (effective Jan. 9, 1989) (NPDW-MCL))

(14) Trichloroethylene (TCE)

(a) CASRN: 79016
(b) CERCLA Hazardous Substance: Yes
(c) Groundwater RI Analyte: Yes
(d) Groundwater IRA Standard: 5 ug/1.
(Source: 40 C.F.R. Section 141.61(a); 52 Fed. Reg. 25716 (1987) (effective Jan. 9, 1989) (NPDW-MCL))

Other selected limitations that were considered relevant and appropriate for this IRA, but are not practicable to attain within its context, while maintaining the necessary speed of implementation which makes this IRA beneficial and cost-effective are listed below. While this IRA will provide substantial benefits and significant treatment of groundwater inside of the Arsenal, some compounds, particularly inorganics, are not expected to be treated to selected levels. However, the significant benefits that can be attained by the relatively rapid implementation of this system IRA make going forward with its implementation the appropriate course of action to take. Compounds requiring additional treatment in the future may be addressed by improvements to this system or within the context of the Final Response Action or both, as appropriate. These compounds are:

(1) Chromium

(a) CERCLA Hazardous Substance: Yes
(b) Groundwater RI Analyte: Yes
(c) Groundwater IRA Standard: 50 ug/l
(Source: 40 C.F.R. Section 141.11(b) (NPDW-MCL))

(2) Flouride

(a) CERCLA Hazardous Substance: No
(b) Groundwater RI Analyte: Yes
(c) Groundwater IRA Standard: 4,000 ug/l
(Source: 40 C.F.R. Section 141.11(c) (NPDW-MCL))

(3) Nitrate

(a) CERCLA Hazardous Substance: No
(b) Groundwater RI Analyte: Yes
(c) Groundwater IRA Standard: 10,000 ug/l
(Source: 40 C.F.R. Section 141.11(b) (NPDW-MCL))

The Army has selected, and anticipates attaining, the following limitation which is based upon the currently available health data for the listed compound for which there is no promulgated standard:

(1) DIMP

(a) CERCLA Hazardous Substance: No
(b) Groundwater RI Analyte: Yes
(c) Groundwater IRA Standard: 9730 ug/l
(Source: Technical Report 8302, U.S. Army Medical Bioengineering Research & Development Laboratory, October 1984)

A list of target analytes for this IRA is contained in Table 4.3-1 of the Final Alternatives Assessment. Target analytes for which promulgated standards were not found were Chlorophenylmethyl sulfide, Chlorophenylmethyl sulfone, Chlorophenylmethyl sulfoxide, Dibromochloropropane, Dicyclopentadiene, Dithiane, Oxathiane, Calcium, Chloride, Magnesium, Potassium, Sodium, Sulfate, and Zinc. It is anticipated that several of these compounds will receive substantial treatment by the system contemplated by this IRA.

If further contaminants are identified after the implementation of the treatment system, chemical-specific ARARs will be reviewed for such contaminants and established, as appropriate.

While the Army believes that this manner of standard-setting is appropriate in the circumstances of this interim action, it should be emphasized that this represents quite a different approach from the process of ARAR selection that will be employed by the Army for the On-Post Operable Unit Final Response Action, consistent with the terms of CERCLA, the NCP, pertinent EPA guidance and the proposed Consent Decree. Thus, the standards identified in this context will not necessarily qualify as any or all of the ARARs to be designated in the latter context.

8.3.2 LOCATION-SPECIFIC ARARs

Location-specific requirements set restrictions on activities depending on the characteristics of the site or the immediate environment. These requirements function like action-specific requirements. Alternative remedial actions may be restricted or precluded depending on the location or characteristics of the site and the requirements that apply to it.

With respect to this interim action, the provisions of 40 CFR Section 141.5 (siting requirements for public water systems) are relevant and appropriate. The foregoing regulation does not constitute an applicable location-specific ARAR in this context. The Basin A Neck intercept and treatment system does not constitute a public water system; therefore, the regulatory jurisdiction otherwise associated with the Safe Drinking Water Act and the National Primary Drinking Water Regulations does not arise. In these circumstances, the nature of the remedial action is such that the jurisdictional prerequisites of these requirements are not met. Thus, the identified regulation is not applicable here.

Nevertheless, Section 141.5 does address location-specific problems or situations sufficiently similar to those encountered at the RMA CERCLA site so that use of this regulation is well-suited to the site and accordingly it will be treated as relevant and appropriate. A requirement that is relevant and appropriate must be complied with to the same degree as if applicable. However, there is more discretion in this determination; it is possible for only part of a requirement to be considered relevant and appropriate; the last being dismissed if judged not to be relevant and appropriate in a given case.

Accordingly, the Basin A Neck intercept and treatment system will be located to conform to the substantive siting provisions of 40 CFR Section 141.5 as follows:

(i) The system will not be located where there is a significant risk from earthquakes, floods, fires or other disasters which could cause a breakdown of these improvements; and

(ii) The system will not be located within the floodplain of a 100-year flood.

It should be noted that Paragraphs 23.2(e) and (f) of the proposed Consent Decree provide that:

(e) Wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act, 16 U.S.C. Sections 1531 et seq., migratory birds to the extent required by the Migratory Bird Treaty Act, 16 U.S.C. 703 et seq., and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. Section 668 et seq.

(f) Other than as may be necessary in connection with a Response Action or as necessary to construct or operate a Response Action Structure, there shall be no change permitted in the geophysical characteristics of RMA that has a significant effect on the natural drainage at RMA for floodplain management, recharge of groundwater, operation and maintenance of Response Action Structures, and protection of wildlife habitat(s).

While these provisions are not ARARs, they obviously must be complied with for purposes of this IRA. Based on where the Basin A Neck intercept and treatment system will be located, as well as when and where IRA will take place, the Army believes that this IRA will have no adverse impact on any endangered species or migratory birds, or on the protection of wildlife habitats. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure no such adverse impact arises from implementations of this IRA.

Moreover, the Army has separately determined that this IRA will not change the physical characteristics of RMA in a manner that will have significant effect on the natural drainage of RMA for floodplain management, recharge of groundwater or the operation and maintenance of Response Action Structures.

8.3.3 ACTION-SPECIFIC ARARs

8.3.3.1 DESCRIPTION

Performance, design or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions or technologies, as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

8.3.3.2 CONSTRUCTION OF INTERCEPT AND TREATMENT SYSTEM

(i) Air Emissions

On the remote possibility that there may be air emissions during the course of the construction of the Basin A Neck intercept and treatment system, the Army has reviewed all potential ambient or chemical-specific air emission requirements. As a result of this review, the Army found that there are, at present, no National or State ambient air quality standards currently applicable or relevant and appropriate to any of the volatile or semi-volatile chemicals in the groundwater found in the immediate vicinity of the Basin A Neck area.

Of course, in the context of this IRA there is only a very remote chance of any release of volatiles or semi-volatiles and, even if such a release did occur, it would only be intermittent and of very brief duration (because the activity that produced the release would be stopped and modified appropriately if a significant air emission was detected by the contractor's air monitoring specialist). The site-specific Health and Safety Plan to be developed for use in this IRA will detail the procedures to be followed to monitor for air emissions of volatiles and semi-volatiles and detail operational modifications to be implemented in the event monitoring detects specific levels of such emissions.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) were evaluated to determine whether they were applicable or relevant and appropriate to apply in the context of this IRA. These standards were not considered applicable because they apply to stationary sources of these pollutants, not to construction activity. They were not considered relevant and appropriate since they were developed for manufacturing processes which are significantly dissimilar to the short-term construction activity contemplated by this IRA. However, if an air stripper is included in the final design, these and other potential air emission ARARs will be reviewed again to determine whether they should be considered applicable or relevant and appropriate to the intended operation of such an air stripper.

(ii) Worker Protection

With respect to the workers directly participating in this IRA, the worker protection requirements of Section 126 of the Superfund Amendments and Reauthorization Act of 1986 shall be met through compliance with the OSHA interim final rule that appears in 51 Fed. Reg. 45654 (1986).[1]

8.3.3.3 GENERAL CONSTRUCTION ACTIVITIES

The following performance, design or other action-specific State ARARs have been preliminarily identified by the Army as relevant and appropriate to this portion of the IRA and more stringent than any applicable or relevant and appropriate Federal standard, requirement, criterion or limitation:

(i) Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 100-3, Part III(D) (2) (b), "Construction Activities":

a. Applicability - Attainment and Nonattainment Areas

b. General Requirement - Any owner or operator engaged in clearing or leveling of land or owner or operator of land that has been cleared of greater than one (1) acre in nonattainment areas from which fugitive particulate emissions will be emitted shall be required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize such emissions, in accordance with the requirements of Section III.D. of this regulation.

c. Applicable Emission Limitation Guideline - Both the 20 percent opacity and the no off-property transport emission limitation guidelines shall apply to

---

[1]Although OSHA proposed a permanent final rule on August 10, 1987, 52 Fed. Reg. 29620, the comment period on this rule did not close until October 5, 1987. It should be noted that, pursuant to CERCLA Section 301(f), 42 U.S.C. Section 9651(f), the NCP is to be amended by December 11, 1988 to provide procedures for the protection of the health and safety of employees involved in response actions.

construction activities; except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall be evaluated for compliance with the requirements of Section III.D. of this regulation. (Cross Reference: Subsections e. and f. of Section III.D.2 of this regulation.)

d. Control Measures and Operating Procedures - Control measures or operational procedures to be employed may include, but are not necessarily limited to, planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks and other methods or techniques.

(ii) Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, "Diesel-Powered Vehicle Emission Standards for Visible Pollutants":

a. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered vehicle any air contaminant, for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40 percent opacity, with the exception of Subpart b below.

b. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated diesel-powered vehicle of over 8,500 lbs gross vehicle weight rating operated above 7,000 feet (mean sea level), any air contaminant for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 50 percent opacity.

c. Diesel-powered vehicles exceeding these requirements shall be exempt for a period of 10 minutes, if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position.

d. This standard shall apply to motor vehicles intended, designed and manufactured primarily for use in carrying passengers or cargo on roads, streets and highways.

The following performance, design or action-specific State ARAR is applicable to this portion of the IRA and is more stringent than any applicable or relevant and appropriate Federal standard, requirement, criterion or limitation:

(iii) Colorado Noise Abatement Statute, C.R.S. Section 25-12-103:

a. Every activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of 25 feet or more therefrom in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any 1-hour period.

c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of 5 db(A) less than those listed in Subpart a of this section.

d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

e. For the purposes of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than 5 miles per hour.

f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements.

In substantive fulfillment of Colorado Air Pollution Control Commission Regulation No. 1, this IRA will employ the specified methods for minimizing emissions from fuel burning equipment and construction activities. In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the construction shall be operated in a manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

8.3.3.4 WETLANDS IMPLICATIONS

Through examination of the general area where any system would be located, the Army does not believe any wetlands could be adversely affected. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

8.3.3.5 REMOVAL OF SOIL

There are no action-specific ARARs that pertain to the drilling or excavation of soil during the construction of the Basin A Neck intercept and treatment IRA.

Although not an ARAR, removal of soil from the areas where the intercept and treatment system will be located will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan -- Sampling Waste Handling (November 1987) and EPA's July 12, 1985 memorandum entitled EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation and Decontamination During CERCLA RI/FS Operations at the Rocky Mountain Arsenal. In general, any soils generated by excavation during the course of this IRA, either at surface or subsurface, will be returned to the location from which they originated (i.e., last out, first in). Any materials remaining after backfilling has been completed that are suspected of being contaminated based on field screening techniques,[2] will be properly stored, sampled, analyzed, and ultimately disposed of as CERCLA hazardous wastes,[3] as appropriate.

For materials determined to be hazardous waste, substantive RCRA provisions are applicable to their management. These substantive provisions include, but are not limited to: 40 CFR Part 262 (Subpart C, Pre-Transport Requirements), 40 CFR Part 263 (Transporter Standards), and 40 CFR Part 264 (Subpart I, Container Storage and Subpart L, Waste Piles). The specific substantive standards applied will be determined by the factual circumstances of the accumulation, storage or disposal techniques actually applied to any such material.

---

[2]The field screening techniques to be used to determine contamination are HNU, OVA, discoloration (visual) and odor. Readings or visual and odor inspection will be taken at least every five feet.

[3]It should be noted that the "land ban" provisions of RCRA Section 3004, 42 U.S.C. Section 6924, may be applicable to any such excavated soil that is identified as contaminated. Guidance concerning this matter is currently being developed by Headquarters, U.S. EPA.

9.0 SCHEDULE

The Draft Implementation Document will be completed September 16, 1989. The construction schedule will be contained in the Draft Implementation Document for this IRA. This milestone has been developed based upon the Final Assessment Document and the assumption that no dispute resolution will occur. The Draft Implementation Document will contain a schedule of milestones for the construction of the proposed system. If events occur which necessitate a schedule change or extension, the change will be incorporated in accordance with the discussion in Section XVIII of the RI/FS Process Document.

10.0 CONSISTENCY WITH THE FINAL RESPONSE ACTION

The purpose of this IRA is to prevent the spread of contamination via aquifer flow through the Basin A Neck pending implementation of the Final Response Actions. Although the Final Response Actions have not been selected at this time, this IRA will be consistent with and contribute to the efficient performance of Final Response Actions through the reduction of contaminant migration and the remedial effects on groundwater at RMA.

11.0 REFERENCES

RIC 87198R01
COE, Sirrine Environmental Consultants. June 1987. Final Engineering Report, Literature Research and Review of Groundwater Quality and Treatment Systems for Basin F.

Consent Decree. 1988, June. United States of America, Plaintiff vs. Shell Oil Company, Inc., Defendant. In the United States District court for the District of Colorado. Civil Action No. 83-2379.

Ebasco Services Incorporated. September 1987. Draft Final Task 26 Interim Response Action Assessment, Version 2.1.

Ebasco Services Incorporated. September 1988. Final Basin A Neck Groundwater Intercept and Treatment System Interim Response Action Alternatives Assessment, Version 3.2.

RIC 82295R01
May, J.H. 1982. Regional Groundwater Study of Rocky Mountain Arsenal, Denver, Colorado, Report 1, Hydrogeologic Definition. Technical Report GL-82-6. Vicksburg, Mississippi: U.S. Army Engineers Waterways Experiment Station.

RIC 83299R01
May, J.H., J.D. Crabtree, R.W. Hunt and W.L. Murphy. 1983. Hydrogeology of Basin A/South Plants Area, Rocky Mountain Arsenal, Denver, Colorado, Phase I, Final Report. Technical Report GL-83-11. Vicksburg, Mississippi: U.S. Army Engineers Waterways Experiment Station.

Morrison-Knudsen Engineers, Inc. August 1987. Basin A Neck Groundwater Recovery and Injection System. Prepared for Holme Roberts and Owen, Denver, Colorado.

Morrison-Knudsen Engineers, Inc. September 1988. Basin A Neck Drilling and Water Level Data. Prepared for Holme Roberts and Owen, Denver, Colorado.

Rezai, M. 1982, May 10. Denver Plant Groundwater Treatment Pilot Plant Study. Technical Report No. 82-2. Shell Development Company Technical Department, Denver Plant.

RIC 84153R01
Stearns-Roger Engineering Corporation. November 1983. South Plants Groundwater Treatment Pilot Plant Rocky Mountain Arsenal, Denver, Colorado. Prepared for Department of the Army U.S. Army Toxic and Hazardous Materials Agency.

APPENDIX

COMMENTS AND RESPONSES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2405

Ref: 8HWM-SR

OCT 26 '88

Mr. Donald L. Campbell
Deputy Program Manager
Rocky Mountain Arsenal
ATTN: AMXRM-TO
Commerce City, Colorado 80022-2180

Re: Rocky Mountain Arsenal (RMA), Proposed Decision Document for the Interim Response Action for the Basin A Neck Groundwater Intercept and Treatment System, September, 1988.

Dear Mr. Campbell:

We have reviewed the above referenced report. No final alternative was chosen. The IRA, as described in Section 9.1(e) of the Consent Decree, should be conducted in conformance with provisions 9.5 through 9.14. The IRA should be consistent with and contribute to the efficient performance of Final Response Actions or provide an orderly transition from IRAs to Final Response actions. Section 9.6 of the Consent Decree suggests six criteria to evaluate alternatives. The goal of the alternatives assessment is to select the most cost-effective alternative for obtaining the objective for the IRA. The IRAs, to the maximum extent possible, shall attain ARARs prior to or as part of the draft assessment issued per 9.6. Section 9.8 concerns the issuance of a proposed IRA decision that, among other criteria, sets out the rationale for the alternative selected and presents the final ARAR decisions. The submitted document does not fulfill its purpose in choosing and evaluating the most cost effective alternative.

The Environmental Protection Agency suggests that the document be reissued or amended in conformance with the framework utilized for previous IRAs on the Rocky Mountain Arsenal so that the other parties can make full and knowledgeble comment. We have discussed this matter and the selection of ARARs with you and are amenable to further discussions to resolve these concerns.

If selection and proposal of a treatment method, due to limited data, is impossible at this time, a request for extension should be considered. Please contact me at (303) 293-1528, if there are questions on this matter.

Sincerely,

Connally Mears

Connally Mears
EPA Coordinator
for Rocky Mountain Arsenal Cleanup

Enclosure

cc: Thomas P. Looby, CDH
David Shelton, CDH
Patricia Bohm, CAGO
Lt. Col. Scott Isaacson
Chris Hahn, Shell
R. D. Lundahl, Shell
David Anderson, DOJ

COMMENTS ON THE PROPOSED DECISION DOCUMENT
FOR THE INTERIM RESPONSE ACTION FOR
BASIN A NECK GROUNDWATER INTERCEPT AND TREATMENT SYSTEM
SEPTEMBER, 1988

1. Final decisions should appear in this document, as stated in the cover letter. The purpose of the Proposed Decision Document is to select and evaluate the most cost-effective alternative to accomplish the IRA. The idea of extending the Decision Document deadline is still possible, but now apparently unnecessary. Agreement has been reached through recent discussions to state a selected remedy in the Draft Final Decision Document. Therefore, several modifications to the text may prove necessary, including at such locations as: page 11 ("additional analytical data are required for design"); page 13, Section 4.0; page 16, third paragraph (discuss the economic benefits of reducing the recirculation of treated water by means of a physical barrier); page 25, first paragraph; page 25, second paragraph; page 25, Section 6.2; page 36, Section 8.3.3.4 (it is stated that action-specific ARARs have been "preliminarily identified;" final determinations should be made at this time).

2. Page 12, reword the fourth objective to say "accelerate groundwater remediation".

3. Page 16, Section 4.2, first paragraph, the elimination of inorganic treatment in this IRA solely on the basis of practice at the three boundary groundwater intercept/treatment systems is not an acceptable approach. In discussing possible inorganic treatment, the design needs to be flexible to allow the later addition of inorganic treatment and to be consistent with a final remedy. EPA recommends the regular monitoring of chromium and fluoride levels; if these levels exceed standards, it may be necessary to modify the treatment scheme.

4. Page 18 and Page 26, concerning air stripping, air emissions controls to capture contaminants have been found necessary in other situations, for public health considerations and to meet the permanency requirements of SARA. Inclusion of such phrases as "if required" tend to lead the reader to believe that the need for such controls is highly questionable.

5. Page 25, Section 6.1, it is stated that "the selection of a barrier (if any) ... will be decided during the design phase;" that is repeated later. That language could lead one to believe that a "no barrier" option is viable, whereas it is certain that at least a "hydraulic barrier" will be included.

6. Page 34, fifth paragraph, the United States Fish and Wildlife Service should confirm the Army's assertion that this IRA will not impact adversely endangered species, migratory birds, or wildlife habitats.

7. Page 35, Section 8.3.3.2, the elimination of action-specific ARARs on the basis of existing and continuing restrictions on the groundwater use at RMA is not an acceptable approach.

8. Page 35, Section 8.3.3.3, third paragraph, an air stripper is being considered as a treatment option; hence, emission standards for chemicals in the groundwater in the Basin A Neck area must be evaluated as ARARs.

9. Page 40, to comply with the proposed Consent Decree, the scheduling discussion should provide IRA construction start and completion deadlines as provided in Section 9.8 of the Decree.

10. Page 30, Section 8.2, add descriptions of the later ARARs identification and selection efforts by the parties involved.

11. Page 39, the return of "last out, first in" applies only to excavated soils and not those produced from drilling. The soils produced from drilling are not to be returned in such a manner, but rather handled in accordance with the 7/12/85 EPA memorandum.

12. Page 35, Section 8.3.3.3, second paragraph, it should be stated that the Health and Safety Plan will detail the procedures to be followed in the event that volatile or semi-volatile emissions occur. That clarification has been included in the Decision Documents for the other IRAs.

13. Page 23, provide more documentation on the ARARs selection process, the IRA Assessment document, and the input received from the involved parties on those documents.

14. Page 30, Section 8.3.1, second paragraph, reword the first sentence to state: " The purpose of this IRA is to reduce the level of contamination in the groundwater in Basin A Neck, to improve the efficiency and efficacy of treatment by the RMA boundary systems, and to accelerate the remediation of RMA groundwater."

15. Page 30, we have the following comments on the chemical-specific ARARs listed on pages 30-33.

a. It would help to have in this document a list that is comprehensive and inclusive of all contaminants present in the groundwater.

b. The language should state "selection" of the limits from the respective laws as ARARs for this IRA. Then identify the extent to which they can be achieved.

c. ARARs for inorganics must be identified. Then justification should be provided why it is or is not now practicable to meet them as part of this IRA.

d. If additional contaminants are found after the treatment process commences, chemical-specific ARARs should be established for them.

e. If there are sufficient quantities of solvents, dioxin, California list wastes (As, Cd, Cr VI, Pb, Hg, Ni, Se, and Tl) or first third wastes listed as RCRA hazardous wastes present, possible land ban implications should be addressed.

f. We have the remaining remarks regarding chemical-specific ARARs: are aldrin, dibromochloropropane (DBCP), diisopropylmethylphosphonate (DIMP), dicyclopentadiene (DCPD), methylisobutyl ketone (MIBK), methylene chloride, or tetrachloroethylene in Basin A ground water (pages 17, 18, 19, and 22)? If these contaminants are present, they should be addressed per 42 USC 9621 (d).

16. Page 35, A location-specific ARAR that may possibly be applicable, or relevant and appropriate concerns wetlands.

17. Page 39, Footnote 3, this statement is dependent on additional information to make conclusions on land-ban implications. Therefore, until contaminants, quantities, etc., are determined the pertinence of the land-ban provisions cannot be determined.

18. EPA is in accord with the State of Colorado Comment 1 contained in their letter of August 1, 1988, offered on the Alternatives Assessment on this IRA.

19. Page 21, continued first paragraph, evaporation is not normally an acceptable alternative for contamination treatment, in that it leads to the transferrence of contaminants from one media (water) to another (air). Such procedures are not consistent with the permanency requirements of SARA and must be discouraged. The permanence of removal procedures in terms of reduction of mobility, toxicity, and volume must play a key role in alternative selection and acceptability, as provided by SARA.

20. Page 25, Section 6.2, item number 1 should state: "Ability of selected process to attain the discharge standards determined by the ARAR selection process."

RESPONSES TO COMMENTS BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION VIII, ON THE PROPOSED DECISION DOCUMENT FOR THE INTERIM RESPONSE ACTION FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND TREATMENT SYSTEM SEPTEMBER, 1988

1. Final decisions should appear in this document, as stated in the cover letter. The purpose of the Proposed Decision Document is to select and evaluate the most cost-effective alternative to accomplish the IRA. The idea of extending the Decision Document deadline is still possible, but now apparently unnecessary. Agreement has been reached through recent discussions to state a selected remedy in the Draft Final Decision Document. Therefore, several modifications to the text may prove necessary, including at such locations as: page 11 ("additional analytical data are required for design"); page 13, Section 4.0; page 16, third paragraph (discuss the economic benefits of reducing the recirculation of treated water by means of a physical barrier); page 25, first paragraph; page 25, second paragraph; page 25, Section 6.2; page 36, Section 8.3.3.4 (it is stated that action-specific ARARs have been "preliminarily identified:" final determinations should be made at this time).

Response: EPA's comments do not consider the level of decisions either possible or necessary at the time of issuance of Alternative Assessment or Decision Documents. Specifically, its comments do not address the fact that informed choices at the process level are only possible on the basis of preliminary design and cost calculations which will not always be available in accordance with IRA deadlines. Nonetheless, data on aquifer properties in the A Neck area were acquired concurrently with development of the Draft Final Decision Document, enabling decisions at the process level to be incorporated into the Draft Final Decision Document with respect to the preferred types of barriers, and extraction and injection systems for this IRA.

Also, the text has been modified to reflect the selection of activated carbon absorption preceded by packed column air stripping as the treatment system for this IRA.

2. Page 12, reword the fourth objective to say "accelerate groundwater remediation".

Response: The text has been revised in response to this comment.

3. Page 16, Section 4.2, first paragraph, the elimination of inorganic treatment in this IRA solely on the basis of practice at the three boundary groundwater intercept/treatment systems is not an acceptable approach. In discussing possible inorganic treatment, the design needs to be flexible to allow the later addition of inorganic treatment and to be consistent with a final remedy. EPA recommends the regular monitoring of chromium and

fluoride levels; if these levels exceed standards, it may be necessary to modify the treatment scheme.

Response: Section 4.2 has been modified to reflect EPA's comments that the treatment system design should be flexible to allow the potential addition of inorganic treatment processes. Chromium and fluoride levels will be monitored on a regular basis.

4. Page 18 and Page 26, concerning air stripping, air emissions controls to capture contaminants have been found necessary in other situations, for public health considerations and to meet the permanency requirements of SARA. Inclusion of such phrases as "if required" tend to lead the reader to believe that the need for such controls is highly questionable.

Response: The text has been revised in response to this comment.

5. Page 25, Section 6.1, it is stated that "the selection of a barrier (if any) ... will be decided during the design phase;" that is repeated later. That language could lead one to believe that a "no barrier" option is viable, whereas it is certain that at least a "hydraulic barrier" will be included.

Response: Section 6.1 has been revised and now describes a preferred barrier system based on recently acquired data on the characteristics of the alluvial aquifer.

6. Page 34, fifth paragraph, the United States Fish and Wildlife Service should confirm the Army's assertion that this IRA will not impact adversely endangered species, migratory bird, or wildlife habitats.

Response: The U.S. Fish and Wildlife Service has been requested to review this issue.

7. Page 35, Section 8.3.3.2, the elimination of action-specific ARARs on the basis of existing and continuing restrictions on the groundwater use at RMA is not an acceptable approach.

Response: The text has been revised in response to this comment.

8. Page 35, Section 8.3.3.3, third paragraph, an air stripper is being considered as a treatment option; hence, emission standards for chemicals in the groundwater in the Basin A Neck area must be evaluated as ARARs.

Response: The text has been revised in response to this comment.

9. Page 40, to comply with the proposed Consent Decree, the scheduling discussion should provide IRA construction start and completion deadlines provided in Section 9.8 of the Decree.

Response: The text has been revised to indicate that the construction schedule for this IRA will be contained in the Implementation Document.

10. Page 30, Section 8.2, add descriptions of the later ARARs identification and selection efforts by the parties involved.

Response: The text has been revised in response to this comment.

11. Page 39, the return of "last out, first in" applies only to excavated soils and not those produced from drilling. The soils produced from drilling are not to be returned in such a manner, but rather handled in accordance with the 7/12/85 EPA memorandum.

Response: The Army's intent is consistent with EPA's comment. The text has been revised to clarify this concern.

12. Page 35, Section 8.3.3.3, second paragraph, it should be stated that the Health and Safety Plan will detail the procedures to be followed in the event that volatile or semi-volatile emissions occur. That clarification has been included in the Decision Documents for the other IRAs.

Response: The text has been revised in response to this comment.

13. Page 23, provide more documentation on the ARARs selection process, the IRA Assessment document, and the input received from the involved parties on those parties on those documents.

Response: The text has been revised in response to this comment.

14. Page 30, Section 8.3.1., second paragraph, reword the first sentence to state: "The purpose of this IRA is to reduce the level of contamination in the groundwater in Basin A Neck, to improve the efficiency and efficacy of treatment by the RMA boundary systems, and to accelerate the remediation of RMA groundwater."

Response: The text has been revised in response to this comment.

15. Page 30, we have the following comments on the chemical-specific ARARs listed on pages 30-33.

a. It would help to have in his document a list that is comprehensive and inclusive of all contaminants present in the groundwater.

Response: The text has been revised in response to this comment.

b. The language should state "selection" of the limits from the respective laws as ARARs for this IRA. Then identify the extent to which they can be achieved.

Response: The text has been revised in response to this comment.

c. ARARs for inorganics must be identified. Then justification should be provided why it is or is not now practicable to meet them as part of this IRA.

Response: The text has been revised in response to this comment.

d. If additional contaminants are found after the treatment process commences, chemical-specific ARARs should be established for them.

Response: The Army agrees with EPA's comment and will proceed accordingly if additional contaminants are discovered.

e. If there are sufficient quantities of solvents, dioxin, California list wastes (As, Cd, Cr VI, Pb, Hg, Hi, Se, and Tl) or first third wastes listed as RCRA hazardous wastes present, possible land ban implications should be addressed.

Response: The text has been revised to discuss the possibility that land ban requirements will affect this IRA.

f. We have the remaining remarks regarding chemical-specific ARARs: are aldrin, dibromochloropropane (DBCP), diisopropylmethylphosphonate (DIMP), dicyclopentadiene (DCPD), methylisobutyl ketone (MIBK), methylene chloride, or tetrachloroethylene in Basin A ground water (pages 17, 18, 19, and 22)? If these contaminants are present, they should addressed per 42 USC 9621 (d).

Response: The text has been revised to discuss those listed contaminants actually detected in the Basin A Neck ground water.

16. Page 35, A location-specific ARAR that may possibly be applicable, or relevant and appropriate concerns wetlands.

Response: The text has been revised to discuss wetlands implications.

17. Page 39, Footnote 3, this statement is dependent on additional information to make conclusions on land-ban implications. Therefore, until contaminants, quantities, etc., are determined the pertinence of the land-ban provisions cannot be determined.

Response: The footnote has been revised to indicate that the implications of the land ban are not completely clear at this time.

18. EPA is in accord with the State of Colorado Comment 1 contained in their letter of August 1, 1988, offered on the Alternatives Assessment on this IRA.

Response: The Army believes that the revisions made to the text of this document address this concern.

19. Page 21, continued first paragraph, evaporation is not normally an acceptable alternative for contamination treatment, in that it leads to the transference of contaminants from one media (water) to another (air). Such procedures are not consistent with the permanency requirements of SARA and must be discouraged. The permanence of removal procedures in terms of reduction of mobility, toxicity, and volume must play a key role in alternative selection and acceptability, as provided by SARA.

Response: Agreed. The text recommends use of other processes.

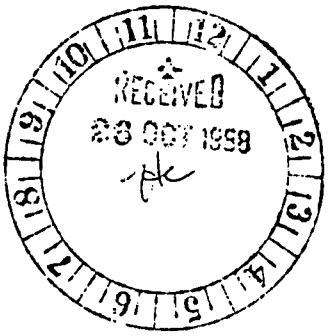
20. Page 25, Section 6.2, item number 1 should state: "Ability of selected process to attain the discharge standards determined by the ARAR selection process."

Response: The text has been revised in response to this comment.

STATE OF COLORADO

COLORADO DEPARTMENT OF HEALTH

4210 East 11th Avenue
Denver, Colorado 80220
Phone (303) 320-8333



Roy Romer
Governor

Thomas M. Vernon, M.D.
Executive Director

October 25, 1988

Mr. Donald Campbell
Program Manager
Office of the Program Manager
for the Rocky Mountain Arsenal
AMXRM-PM, Building 111
Commerce City,. Colorado 80022-2180

Re: Proposed Decision Document for the Basin A Neck Groundwater Intercept and Treatment System Interim Response Action at the Rocky Mountain Arsenal, September 1988

Dear Mr. Campbell:

Enclosed are the State's comments on the above-referenced document. Nonetheless, the State is supportive of the concept of the Basin A neck intercept and treatment system and urges the Army to expedite its construction and operation.

If you have any questions regarding these comments, please contact Mr. Jeff Edson with this Division.

Sincerely yours,

David C. Shelton
Director
Hazardous Materials and
Waste Management Division

cc: Michael R. Hope, AGO
David L. Anderson, DOJ
Scott P. Isaacson, Army
Chris Hahn, Shell Oil
Edward J. McGrath, HRO
Michael Gaydosh, EPA
Connally Meers, EPA
Tony Truschel, GeoTrans

DS/lh

STATE COMMENTS ON PROPOSED DECISION DOCUMENT
FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND
TREATMENT SYSTEM INTERIM RESPONSE ACTION AT THE
ROCKY MOUNTAIN ARSENAL, SEPTEMBER 1988

GENERAL COMMENTS

1. The State has previously informed the Army that it supports all efforts which will result in the expeditious cleanup of the RMA and the reduction of the current threat to public health and the environment. The Basin A neck intercept and treatment system should be constructed and operated as soon as possible. The Draft Final Technical Program Schedule presented to the MOA parties indicates that the system will not be operational until April 1991. The Decision Document should include a complete schedule and an explanation of the apparently extended periods of time for the design of and field work necessary to implement this interim action.

2. The upper Denver sands are also known to be contaminated in the Basin A neck area. The proposed decision document indicates that the extraction wells will be constructed to remove contamination only from the Alluvial aquifer. This design could result in contamination migrating under the extraction wells or through the Denver sands. Therefore, the design document must evaluate whether deeper extraction wells will be capable of effectively intercepting and treating the contamination detected in the upper Denver sands. If it appears technically feasible, the system should be constructed to intercept all contamination in the upper Denver Formation.

3. Further characterization of the Basin A neck hydrology and contaminant distribution is needed prior to the selection of the exact location for the system. Four important aspects of a more detailed siting study need to be considered and addressed in the Decision Document. First, the location of the intercept system downgradient of subcropping Denver sand units may result in increased capture of flux being discharged from the Denver units. Second, locating the system closer to the sources (i.e. South Plants area) could result in capturing more contaminants before they migrate into the underlying Denver formation. However, by locating the intercept system upgradient of the "neck" (toward Section 1), the desirable constriction occuring at the "neck" would be lost. Third, the faults and/or fault zones appear to affect the shallow aquifer flow and may affect the operation of the extraction and/or injection systems. Fourth, the northeast Denver sand conduit may have a significant affect on the flow and contaminant movement in the shallow aquifer. These aspects should be investigated and addressed in the Decision Document to assure the optimal site for the system.

4. To the extent that the interim action will not be delayed, the State recommends that a numerical groundwater model be used to help locate and design the Basin A neck system. The model could be used to evaluate optimum extraction and injection well configurations, potential induced verticle gradients between Denver units and the alluvial aquifer, the feasibility of extracting groundwater from the upper Denver units, and the potential for recirculation of waters between the injection and extraction wells.

The model could be developed in cross-section, offering considerable savings in labor and computer costs, while providing valuable hydrologic information.

5. At a minimum, the Army and DOJ should have selected action levels for the "target analytes" which were identified in the Final Alternatives Assessment report for this interim action. State and federal standards exist for most of these analytes. Please explain why these were not selected. The standards should be incorporated as appropriate.

SPECIFIC COMMENTS

1. Pgs. 5-10, Description of the Basin A Neck. - An estimate of width of the saturated alluvium in the area of the proposed wide Basin A Neck location should be provided.

2. Pg. 16 Section 4.2 and Pgs. 25-26 Section 6.2. - Given the levels of chloride, fluoride, nitrate, and sulfate in the groundwater in the Basin A Neck area, the treatment system should be designed and operated to effectively treat inorganic, as well as organic, contaminants to acceptable levels.

3. Pg. 26 Section 6.2. - The evaluation of groundwater quality in the vicinity of the Basin A Neck may not be adequate to design the treatment system. The limited sampling/analyses of some parameters may bias the treatment system design. Therefore, a statement should be included in this section of the Decision Document which commits that the treatment system will be designed with a margin of safety so it will be able to handle unknown concentrations of unexpected contaminants. Also the margin of safety to be incorporated into the design should be specified.

4. Pgs. 30-39, Section 8.0 ARARs. - The State submits the following comments pertaining to the selection of ARARs:

a. Section 121(d) of the Superfund Amendments and Reauthorization Act ("SARA") provides that, "such remedial action shall require a level or standard of control which at least attains Maximum Contaminant Level Goals established under the Safe Drinking Water Act and water criteria established under Section 304 or 305 of the Clean Water Act." Furthermore, on March 27, 1987, the conferees involved in the CERCLA reauthorization process, wrote a letter to the U.S. Environmental Protection Agency "to advise you [Lee Thomas] of the requirements of Section 121 [of SARA] and the intent behind them." That letter also states that, "[t]he specific reference to MCLGs in the law makes it clear that these particular standards, where they are more stringent than the comparable MCLs are the primary standards under the Safe Drinking Water Act that must be attained by Superfund cleanups of groundwater." Therefore, pursuant to statutory requirements, unless the U.S. EPA determines that compliance with MCLGs is technically impracticable from an engineering perspective, MCLGs are the ARARs that must be attained. CERCLA, Section 121(d)(4)(c).

b. As the State has previously informed the Army (see State comments on the proposed Consent Decree), any activity conducted at RMA must be conducted in compliance with all statutes and regulations." However, the Army has consistently ignored all promulgated State statutes and regulations relating to the protection of water quality. This practice is inconsistent with U.S. EPA actions at other Colorado CERCLA sites and is not consistent with Section 121(d) of CERCLA. To the extent that State promulgated standards are more stringent than the federal standards, the State standards must be met. Attachment I contains State identified chemical specific standards which must be attained.

c. The Army should anticipate including the MCLGs and MCLs for the synthetic organics and inorganics which the U.S. EPA is proposing to promulgate under the Safe Drinking Water Act. Once promulgated, these MCLGs and MCLs will be applicable.

Contaminant	Proposed MCLG	Proposed MCL
Arsenic	0 ug/1	30 ug/1
Chlordane	0 ug/1	2 ug/1
DBCP	0 ug/1	.2 ug/1
Trans-1, 2-dichloroethylene	70 ug/1	70 ug/1
Ethyl benzene	700 ug/1	700 ug/1
Tetrachloroethylene	0 ug/1	2 ug/1
Xylene	10,000 ug/1	10,000 ug/1

d. Pg. 21-(5) Chloroform. The groundwater standard for chloroform should be 0.19 ug/l. Source: Federal Clean Water Act, in particular Water Quality Criteria for Protection of Human Health. It is inappropriate for the Army and DOJ to select the total trihalomethanes value of 100 ug/1 as the action level for chloroform. The formation of trihalomethanes are a by-product of disinfection of domestic water supplies. Disinfection is not a necessary process of the treatment system and in fact has not been proposed.

e. Pg. 22-(14) Trichloroethylene (TCE). The groundwater standard for TCE should be 0 ug/1 pursuant to the federal Safe Drinking Water Act MCLG.

f. Location specific ARARs for air emissions will need to be identified and selected if air stripping or similar water treatment processes are required in order to meet all chemical specific ARARs.

5. The State's comments are based upon the Groundwater Intercept and Treatment System as proposed in this document and the Alternatives Assessment report for this interim action. The State reserves the right to identify additional comments, concerns and ARARs in the event this proposal is modified.

ATTACHMENT 1

STATE IDENTIFICATION OF CHEMICAL-SPECIFIC ARARS AT RMA BASIN A NECK

REFERENCE

(1) Colorado Basic Standards for Ground Water, 5 CCR 1002-8, Section 3.11.0 - 3.11.9 (in particular Tables 1, 2, and 3).

(2) Colorado Basic Standards and Methodologies, 5 CCR 1002-8, Section 3.1.0 - 3.1.20 (in particular Section 3.1.11).

(3) Federal Safe Drinking Water Act (in particular Maximum Contaminant Level Goals - MCLGs).

(4) Federal Safe Drinking Water Act (in particular Maximum Contaminant Levels - MCLs).

(5) Federal Clean Water Act (in particular Water Quality Criteria for Protection of Human Health).

Chemical	Abbreviation	Water Quality Standard (Reference) all values in ug/l		
Aldrin	ALDRN	0(2)	0.000074(5)	
Arsenic	AS	50(1)	50(4)	
Atrazine	ATZ	0(2)		
Barium	BA	1000(1)	1000(4)	
Benzene	C6H6		0(3)	5(4)
Benzothiazole	BTA/BTZ	0(2)		
Bicycloheptadiene	BCHPD	0(2)		
Bromoform	CHBR3	100(4)	note: total trihalomethanes	
Cadmium	CD	10(1)	5(3)*	10(4)
Carbon tetrachloride	CCL4		0(3)	5(4)
Chlordane	CLDAN	0.004(1)	0.00046(5)	
Chloride	CL	250,000(1)		
Chlorobenzene	CLC6H5	0(2)		
Chloroform	CHCL3	100(4)	note:total trihalo-methanes	0.19(5)
Chlorophenylmethyl sulfide	CPMS	0(2)		
Chlorophenylmethyl sulfone	CPMSO2	0(2)		
Chlorophenylmethyl sulfoxide	CPMSO	0(2)		
Chromium	CR	50(1)	1.2(3)*	50(4)
Copper	CU	200(1)	1300(3)*	
Dibromochloropropane	DBCP	0(2)	0(3)	
Dichlorobenzenes	CL2BZ		75(3)	75(4)
Dichlorodiphenylethane	PPDDE	0(2)		

Chemical	Abbreviation	Water Quality Standard (Reference) all values in ug/l		
Dichlorodiphenyl trichloroethane	PPDDT	0(2)		
1,1-Dichloroethane	11DCLE	0(2)		
1,2-Dichloroethane	12DCLE		0(3)	5(4)
1,1-Dichloroethylene	11DCE		7(3)	7(4)
1,2-Dichloroethylene	12DCE	0(2)		
2,4-Dichlorophenoxyacetic acid	24D		7(3)	100(4)
Dicyclopentadiene	DCPD	0(2)		
Dieldrin	DLDRN	0(2)	0.000071(5)	
Diisopropylmethyl phosphonate	DIMP	0(2)		
Dimethyldisulfide	DMDS	0(2)		
Dimethylmethylphosphate	DMMP	0(2)		
Dithiane	DITH	0(2)		
Endrin	ENDRN	0.2(1)	0.2(4)	
Ethylbenzene	ETC6H5	0(2)	680(3)*	
Fluoride	F	4000(1)	4000(4)	
Hexachlorocyclopentadiene	CL6CP	0(2)	210(5)	
Iron	FE	300(1)		
Isodrin	ISODR	0(2)		
Lead	PB	50(1)	20(3)*	50(4)
Lindane	LIN	4(1)	0.2(3)*	4(4)
Malathion	MLTHN	0(2)		
Manganese	MN	50(1)		
Mercury	HG	2(1)	2(4)	

Chemical	Abbreviation	Water Quality Standard (Reference) all values in ug/l		
Methoxychlor	MEXCLR	100(1)	100(4)	
Methylene chloride	CH2CL2	0(2)		
Methylisobutyl ketone	MIBK	0(2)		
Nitrite	NIT	1000(1)		
Nitrate		10,000(1)	10,000(4)	
Oxathiane	OXAT	0(2)		
pH	PH	6.5 - 8.5(1)		
Selenium	SE	10(1)	10(4)	
Silver	AG	50(1)	50(4)	
Silvex	SILVEX	10(1)	10(4)	
Sulfate	SO4	250,000(1)		
Supona	SUPONA	0(2)		
Tetrachloroethylene	TCLEE	0(2)	0(3)*	
Toluene	MEC6H5	0(2)	2000(3)*	
Toxaphene	TXPHEN	5(1)	0(3)*	5(4)
1,1,1-Trichloroethane	111TCE		200(3)	200(4)
1,1,2-Trichloroethane	112TCE	0(2)	0.6(5)	
Trichloroethylene	TRCLE		0(3)	5(4)
Unknown	UNK049	0(2)		
Unknown	UNK080	0(2)		
Unknown	UNK104	0(2)		
Unknown	UNK110	0(2)		
Unknown	UNK118	0(2)		

Chemical	Abbreviation	Water Quality Standard (Reference) all values in ug/l
Unknown	UNK129	0(2)
m-Xylene	13DMB	0(2)
Xylenes	XYLEN	0(2)
Zinc	ZN	500(1)

*Proposed Maximum Contaminant Level Goals

RESPONSES TO
COMMENTS BY THE STATE OF COLORADO ON PROPOSED DECISION DOCUMENT
FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND
TREATMENT SYSTEM INTERIM RESPONSE ACTION AT THE
ROCKY MOUNTAIN ARSENAL, SEPTEMBER 1988

GENERAL COMMENTS

1. The State has previously informed the Army that it supports all efforts which will result in the expeditious cleanup of the RMA and the reduction of the current threat to public health and the environment. The Basin A neck intercept and treatment system should be constructed and operated as soon as possible. The Draft Final Technical Program Schedule presented to the MOA parties indicates that the system will not be operational until April 1991. The Decision Document should include a complete schedule and an explanation of the apparently extended periods of time for the design of and field work necessary to implement this interim action.

Response: A more extensive schedule of milestones for this IRA will be provided in the Implementation Document. It is more appropriate to provide further detail in that document because the IRA will have undergone further development and more specific data will be available upon which to base reasonable milestones.

2. The upper Denver sands are also known to be contaminated in the Basin A neck area. The proposed decision document indicates that the extraction wells will be constructed to remove contamination only from the Alluvial aquifer. This design could result in contamination migrating under the extraction wells or through the Denver sands. Therefore, the design document must evaluate whether deeper extraction wells will be capable of effectively intercepting and treating the contamination detected in the upper Denver sands. If it appears technically feasible, the system should be constructed to intercept all contamination in the Upper Denver Formation.

Response: As discussed in the Decision Document, the potentiometric heads measured in the Denver Formation sands that subcrop within the Basin A Neck indicate that groundwater within the sands flows toward the subcrop, discharging into the alluvium. One of the reasons why the 'narrow' neck location for the intercept system is preferred is that it will be downgradient of some of these subcropping sands, and will consequently intercept groundwater discharging from these sands. Pumping from alluvial wells will help to draw water out of the underlying, subcropping Denver sands by reducing the overlying alluvial water table. However, pumping from wells completed in underlying Denver sand subcrops would tend to draw contaminated alluvial groundwater into the Denver sands. After a brief period of operation of the North Boundary Containment System, use of extracted wells completed in the Denver Formation was

discontinued for this very reason. Pumping from the Denver wells appeared to be pulling contamination into the Denver Formation. Therefore, it is recommended that the extraction system not be designed to extend into underlying Denver sands.

3. Further characterization of the Basin A neck hydrology and contaminant distribution is needed prior to the selection of the exact location for the system. Four important aspects of a more detailed siting study need to be considered and addressed in the Decision Document. First, the location of the intercept system downgradient of subcropping Denver sand units may result in increased capture of flux being discharged from the Denver units. Second, locating the system closer to the sources (i.e. South Plants area) could result in capturing more contaminants before they migrate into the underlying Denver formation. However, by locating the intercept system upgradient of the "neck" (toward Section 1), the desirable constriction occurring at the "neck" would be lost. Third, the faults and/or fault zones appear to affect the shallow aquifer flow and may affect the operation of the extraction and/or injection systems. Fourth, the northeast Denver sand conduit may have a significant affect on the flow and contaminant movement in the shallow aquifer. These aspects should be investigated and addressed in the Decision Document to assure the optimal site for the system.

Response: Additional hydrogeological information has recently been obtained in the Basin A Neck area. The text has been augmented accordingly. The new data provide additional confirmation of the general hydrogeological interpretations presented in the Proposed Decision Document.

As noted in the State's comment, locating the intercept system downgradient of subcropping Denver sand units will "result in increased capture of flux being discharged from the Denver units." Moving the system upstream will cause it to be located closer to some of the sources, but it will then be upstream of some of the known (or potential) sources (e.g. those subcropping Denver sands that discharge into the neck, the previous and existing sewer locations, Basin B, Sand Creek Lateral, etc.), and also upstream of a large quantity of contaminated groundwater between the two locations that would consequently continue its migration through the neck.

As stated in the Decision Document, "There is now general agreement among all of the geologic contractors investigating the Basin A Neck Area that recent investigative drilling in the area has not produced any evidence of faulting in or near the Basin A Neck." The Army is not aware of any data that substantiate the State's assertion that " . . . faults and/or fault zones appear to affect the shallow aquifer flow," and disagrees with the assertion.

There is a possibility that some alluvial groundwater flows laterally northward into a Denver sand channel in the vicinity of

D Street on the northern edge of the saturated alluvium. The original cause of this speculation was an opinion held by some that an apparent inconsistency between the flow estimates through the wide and narrow necks could be explained by a flowpath into the Denver sand. Since that time, four aquifer tests have been conducted in the narrow neck. These tests showed the aquifer to be much more permeable than some had originally thought. The current estimate of groundwater flow through the alluvium in the narrow Neck, based on recently measured gradients in the neck and these four tests, is 14 gallons per minute. This estimate is very consistent with the estimate of flow through the wide neck (11 to 14 gpm as discussed in the Decision Document). Also, as stated in the Decision Document, alluvial groundwater contours are curved so as to not provide any indication of significant flows into the Denver formation in this area. As stated in the Decision Document, Denver Sandstone wells downgradient of the subcrop area have not shown contamination consistent with contamination found in the Basin A Neck area alluvial groundwater. In light of these many considerations, the Army is not aware of any evidence that significant flows are exiting into the sandstone subcrop in the Basin A Neck area.

Even through data exist that indicate the lateral flow (if any) into the Denver sand subcrop near D Street is quite minor, it does seem appropriate to study the issue within the On-Post RI/FS. If subsequent investigations show that small flows are entering the Denver sand in this area, remediation can then be planned and implemented, if appropriate.

4. To the extent that the interim action will not be delayed, the State recommends that a numerical groundwater model be used to help locate and design the Basin A neck system. The model could be used to evaluate optimum extraction and injection well configurations, potential induced verticle (sic) gradients between Denver units and the alluvial aquifer, the feasibility of extracting groundwater from the upper Denver units, and the potential for recirculation of waters between the injection and extraction wells.

The model could be developed in cross-section, offering considerable savings in labor and computer costs, while providing valuable hydrologic information.

Response: A 2-D numerical groundwater model of the Basin A Neck alluvial aquifer has been developed. It can be used to evaluate extraction and injection system configurations, as well as to evaluate the magnitude of recirculation between the recharge and extraction systems.

5. At a minimum, the Army and DOJ should have selected action levels for the "target analytes" which were identified in the Final Alternatives Assessment report for this interim action. State and federal standards exist for most of these analytes.

Please explain why these were not selected. The standards should be incorporated as appropriate.

Response: Revisions have been made to this section in response to this comment.

SPECIFIC COMMENTS

1. Pgs. 5-10, Description of the Basin A Neck. - An estimate of width of the saturated alluvium in the area of the proposed wide Basin A. Neck location should be provided.

Response: As shown on Figure 5, the width of the saturated alluvium in the area of the "wide" Basin A Neck is approximately 2800 feet. Such a statement has been incorporated in the text.

2. Pg. 16 Section 4.2 and Pgs. 25-26 Section 6.2. - Given the levels of chloride, fluoride, nitrate, and sulfate in the groundwater in the Basin A Neck area, the treatment system should be designed and operated to effectively treat inorganic, as well as organic, contaminants to acceptable levels.

Response: The development of a treatment strategy for inorganics for this IRA at this time would unduly delay the implementation of this IRA and the resulting significant beneficial effects which can be attained in the near term while further testing and studies are conducted. The system will have the capability to be upgraded in the future to include inorganic treatment, if necessary, in the context of the comprehensive cleanup of RMA. The ability to install this beneficial system within the short-term is considered to be of significant value by the Army.

3. Pg. 26 Section 6.2 - The evaluation of groundwater quality in the Basin A Neck may not be adequate to design the treatment system. The limited sampling/analyses of some parameters may bias the treatment system design. Therefore, a statement should be included in this section of the Decision Document which commits that the treatment system will be designed with a margin of safety so it will be able to handle unknown concentrations of unexpected contaminants. Also the margin of safety to be incorporated into the design should be specified.

Response: Subsequent to issuance of the proposed Decision Document, 11 new monitoring wells have been installed across the alluvial channel at the location proposed for the Basin A Neck IRA intercept system. Six of these wells have been sampled. It is expected that analyses of these samples will provide information on contaminants and contaminant concentrations sufficient for design of the treatment system. Further sampling may also be possible without impact on this IRA's schedule if aforementioned analyses and process design indicates a need for additional data.

While it is impossible to specify a margin of safety for unknown concentrations of unexpected contaminants, judgment will be used in designing this IRA system to allow for uncertainties in the information available for design. A discussion of safety margin relative to these uncertainties and to this IRA's objectives will be included in the Implementation Document.

4. Pgs. 30-39, Section 8.0 ARARs. - The State submits the following comments pertaining to the selection of ARARs:

a. Section 121(d) of the Superfund Amendments and Reauthorization Act ("SARA")provides that, "such remedial action shall require a level or standard of control which at least attains Maximum Contaminant Level Goals established under the Safe Drinking Water Act and Water criteria established under Section 304 or 305 of the Clean Water Act." Furthermore, on March 27, 1987, the conferees involved in the CERCLA reauthorization process, wrote a letter to the U.S. Environmental Protection Agency "to advise you [Lee Thomas] of the requirements of Section 121 [of SARA] and the intent behind them." That letter also states that, "[t]he specific reference to MCLGs in the law makes it clear that these particular standards, where they are more stringent than the comparable MCLs are the primary standards under the Safe Drinking Water Act that must be attained by Superfund cleanups of groundwater." Therefore, pursuant to statutory requirements, unless the U.S. EPA determines that compliance with MCLGs is technically impracticable from an engineering perspective, MCLGs are the ARARs that must be attained. CERCLA, Section 121(d)(4)(c).

Response: The State appears to make no differentiation between an interim response action and a final remedy with this approach. The Army is aware of no guidance from EPA which would apply MCLGs to interim response actions. From a policy perspective, it appears that application of MCLGs to IRAs would be a disincentive to conduct IRAs, the party preferring to develop a single remedial system which might be capable of attaining such standards regardless of the time required. In the interim, no beneficial remediation would occur. In determining which standards are relevant and appropriate to apply to a specific IRA the Army considers the particular facts surrounding that action. This IRA will treat groundwater which will be released in an area where there is no human exposure, this groundwater will flow towards other treatment systems during the following years, where it will be treated again. Under these circumstances, it has been determined by the Army that MCLGs are not relevant and appropriate to apply in the context of this interim action. This approach is consistent with the statutory provision to apply such standards where they are relevant and appropriate under the circumstances. CERCLA Section 121(d)(2)(A).

b. As the State has previously informed the Army (see State comments on the proposed Consent Decree), any activity

conducted at RMA must be conducted in compliance with all statutes and regulations." However, the Army has consistently ignored all promulgated State statues and regulations relating to the protection of water quality. This practice is inconsistent with U.S. EPA actions at other Colorado CERCLA sites and is not consistent with Section 121(d) of CERCLA. To the extent that State promulgated standards are more stringent than the federal standards, the State standards must be met. Attachment I contains State identified chemical specific standards which must be attained.

Response: The Army has reviewed the State standards identified in Attachment I to the State's comments concerning this proposed decision document. The Army previously provided responses concerning the determination that the Colorado Basic Standards for Ground Water, 5 CCR 1002-8 and the Colorado Basic Standards and Methodologies, 5 CCR 1002-8, were neither applicable nor relevant and appropriate to apply in the context of a groundwater treatment system within RMA in response to the State's comments (June 1, 1988) on the Draft ARAR document for the groundwater treatment system proposed to be installed north of Basin F. The State is referred to that discussion.

c. The army should anticipate including the MCLGs and MCLs for the synthetic organics which the U.S. EPA is proposing to promulgate under the Safe Drinking Water Act. Once promulgated, these MCLGs and MCLs will be applicable.

Contaminant	Proposed MCLG	Proposed MCL
Arsenic	0 ug/1	30 ug/1
Chlordane	0 ug/1	2 ug/1
DBCP	0 ug/1	.2 ug/1
Trans-1, 2-dichloroethylene	70 ug/1	70 ug/1
Ethyl benzene	700 ug/1	700 ug/1
Tetrachloroethylene	0 ug/1	2 ug/1
Xylene	10,000 ug/1	10,000 ug/1

Response: The Army understands that the ARAR process is dynamic. However, proposed standards are subject to change prior to their becoming final standards. They may not ever become final standards or they may be revised upwards or downwards. With that knowledge, the Army determined to apply only those standards which have completed the review process and been promulgated as final standards by the regulatory agency concerned.

d. Pg. 21-(5) Chloroform. The groundwater standard for chloroform should be 0.19 ug/1. Source: Federal Clean Water Act, in particular Water Quality Criteria for Protection of Human Health. It is inappropriate for the Army and DOJ to select the total trihalomethanes value of 100 ug/1 as the action level for chloroform. The formation of trihalomethanes are a by-product of disinfection of domestic water supplies. Disinfection is not a necessary process of the treatment system and in fact has not been proposed.

Response: The Army has selected the MCL for this compound as relevant and appropriate to apply in the context of this IRA. The MCL was considered appropriate since it was specifically developed for drinking water and is a requirement for public water systems. Since the treated water released by this IRA will not be used for drinking water, the Army believes treatment to the selected level will provide remediation with a significant margin for safety. The AWQC suggested by the State was developed with other considerations included, such as protection of aquatic resources in surface waters, that are unrelated to the factual context of this IRA and not considered relevant and appropriate to apply in these specific factual circumstances.

e. Pg. 22-(14) Trichloroethylene (TCE). The groundwater standard for TCE should be 0 ug/1 pursuant to the federal Safe Drinking Water Act MCLG.

Response: The Army's approach to the relevancy and appropriateness of MCLG's in interim actions is discussed in response to the State's comment 4a.

f. Location specific ARARs for air emissions will need to be identified and selected if air stripping or similar water treatment processes are required in order to meet all chemical specific ARARs.

Response: The Army understands that, if air stripping is adopted in the future for treatment of groundwater by this IRA system, potential air emission standards will need to be evaluated and ARARs for air emissions may be appropriate.

5. The State's comments are based upon the Groundwater Intercept and Treatment System as proposed in this document and the Alternatives Assessment report for this interim action. The State reserves the right to identify additional comments, concerns and ARARs in the event this proposal is modified.

Response: No response is necessary to this comment.

25 OCT 1988

Shell Oil Company

One Shell Plaza
P.O. Box 4320
Houston, Texas 77210

October 24, 1988

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-PM: Mr. Donald L. Campbell
Rocky Mountain Arsenal, Building 111
Commerce City, Colorado 80022-2180

Dear Mr. Campbell:

Enclosed herewith are Shell Oil's comments on the proposed Basin A Neck IRA Decision Document.

Sincerely,

R. D. Lundahl
Manager Technical
Denver Site Project

RDL:ajg

Enclosure

cc: (w/enclosure)
Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-PM: Col. Wallace N. Quintrell
Bldg. E-4460
Aberdeen Proving Ground, Maryland 21010-5401

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-PM: Mr. Dave Parks
Rocky Mountain Arsenal, Building 111
Commerce City, CO 80022-2180

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-RP: Mr. Kevin T. Blose
Rocky Mountain Arsenal, Building 111
Commerce City, Colorado 80022-2180

Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMXRM-TO: Mr. Brian L. Anderson
Commerce City, Colorado 80022-2180

cc: Mr. David L. Anderson
Department of Justice
c/o Acumenics Research & Technology
999 18th Street
Suite 501, North Tower
Denver, Colorado 80202

Department of the Army
Environmental Litigation Branch
Pentagon, Room 2D444
ATTN: DAJA-LTE: Lt. Col. Scott Isaacson
Washington, DC 20310-2210

Patricia Bohm, Esq.
Office of Attorney General
CERCLA Litigation Section
One Civic Center
1560 Broadway, Suite 250
Denver, CO 80202

Mr. Jeff Edson
Hazardous Materials and Waste Management Division
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

Mr. Robert L. Duprey
Director, Hazardous Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Connally Mears
Air and Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Thomas P. Looby
Assistant Director
Colorado Department of Health
4210 East 11th Avenue
Denver, CO 80220

SHELL OIL COMMENTS ON PROPOSED DECISION DOCUMENT
FOR THE BASIN A NECK GROUNDWATER INTERCEPT AND TREATMENT
SYSTEM RESPONSE ACTION AT THE ROCKY MOUNTAIN ARSENAL
SEPTEMBER, 1988

1. Page 12, first paragraph.

   The second bullet - "(i)mprove the efficiency and efficacy of the boundary treatment system" - should not be listed as a specific objective for the following reasons. First, this objective statement is too vague for design and implementation, e.g., what is meant by system efficiency; what boundary treatment system? Second, although a Basin A Neck intercept/treatment system may have an impact on boundary systems, any impact would occur in the distant future, thus this objective is not appropriate for an interim response action. Third, neither in this document or in the Alternative Assessment document is there any discussion of how this IRA would affect boundary systems.

2. Page 12, fourth bullet.

   This specific objective - "(h)ave a remedial effect on groundwater within RMA" - should also be deleted because it also is too vague and, in addition, is largely embraced in the first specific objective.

3. Page 12, second paragraph.

   Replace the fourth bullet with "Be consistent with and contribute to the efficient performance of Final Response Actions to the maximum extent practicable; and" to reflect the provisions of paragraph 9.5 of the Consent Decree.

4. Page 12, second paragraph.

   Replace the fifth bullet with "Use the most cost-effective alternative for attaining the objective of the IRA" to reflect the provisions of paragraph 9.6 of the Consent Decree.

5. Page 17, second full paragraph.

   In the last sentence, add and chloroform after methylene chloride.

6. Page 18, third line.

   The statement, "spent carbon, if not regenerated, requires disposal as a hazardous waste," should be clarified. The spent carbon would have to be handled as a hazardous waste only if testing indicated that it was a characteristic hazardous waste.

7. Page 20, first full paragraph.

   Add to the end of the last sentence: and will not be further considered.

8. Page 23, September 1987 entry.

   The relevance of this entry is not clear since the Organizations had already agreed to this IRA in the June 5, 1987 filing.

9. Page 25, first paragraph.

   Delete the last two lines of this paragraph and replace with "objectives of this IRA and the criteria considered to achieve those objectives..." to ensure that there is no inconsistency between the statement on page 25 and the objectives and criteria listed on page 12.

10. Page 25, Section 6.0.

    Addition of the paragraph below after the first paragraph of 6.0 will provide useful perspective on this IRA:

    > Since the purpose of this IRA is to minimize the spread of contaminated groundwater through the Basin A Neck (and thus is anticipated to contribute to the efficient performance of Final Response Actions), design goals will focus on the quantity of contaminants captured by the system, rather than on the attainment of a particular treated water quality. Also, because the benefits of this IRA are directly dependent on the time by which this action leads the Final Response Actions, the design and Implementation Plan will emphasize timely completion and start-up."

11. Page 25, Section 6.1.

    In the last sentence, delete the ending starting with "...ability of the resulting system..." and replace with "objectives of this IRA and the criteria considered to achieve those objectives."

12. Page 30, Section 8.1.

In the fourth and fifth lines, replace "applicable or relevant and appropriate Federal and State Standards" with the following definition of ARARs, based upon section 121(d) (2) of CERCLA: "standards, requirements, criteria, or limitations under any Federal environmental laws (or more stringent promulgated standards, requirements, criteria, or limitations under State environmental or facility siting laws) that are legally applicable to the hazardous substance or pollutant or contaminant concerned or are relevant and appropriate under the circumstances of the release or threatened release."

13. Page 30, section 8.2.

This section should be deleted, because it was outside the agreed upon process for identification and selection of ARARs under paragraph 9.7 of the Consent Decree.

14. Page 30, second paragraph of 8.3.1.

The first sentence states: "The purpose of this IRA is to reduce the level of contamination in the groundwater in Basin A Neck in order to improve the efficiency and efficacy of treatment by the RMA boundary systems and thereby to accelerate the remediation of RMA groundwater."

This statement is not consistent with the discussion under 3.0 Interim Response Action Objectives on page 12 and does not accurately capture the objective of this IRA. Moreover, neither in this document nor in the Alternatives Assessment document is there discussion of how this IRA will affect the boundary systems. Shell believes it is unlikely that this IRA can on a cost/benefit basis be justified on the basis of improved efficiency of the RMA boundary systems. The purpose of this IRA is simply to prevent enlargement of the groundwater contamination problem during the five or more years before the Final Response Action for the On-post Operable Unit will be implemented. This purpose is adequately reflected in the first specific objective listed on page 12.

15. Page 30, 8.3.1, Ambient or Chemical-Specific ARARs.

In light of the appropriate purposes for this IRA set forth in comment #14 above, health-based concentration levels should not be considered as ARARs, because no humans will drink the treated groundwater until further treatment at the existing boundary systems or at other future systems that may become part of the remedy. For this reason, the discussion under 8.3.1 and the standards should be deleted because they are health-based. Shell sets forth below additional reasons for deleting the proposed "ambient or chemical-specific" ARARs.

The levels based on the National Primary Drinking Water Standards or MCLs are particularly not relevant and appropriate because they are intended to be protective of water at the tap used for drinking. See arsenic, benzene, carbon tetrachloride, chloroform, 1,2-dichloroethene, 1-1-dichloroethylene, endrin, mercury, 1,1,1-trichloroethane, and trichloroethylene.

Shell further disagrees with the selection of the maximum concentration of constituents in Table 1 of 40 C.F.R. § 264.94 for groundwater protection as ARARs, including ones for arsenic and mercury. These standards are intended to apply at the boundary of a waste management area and to trigger corrective action for surface impoundments, waste piles and land treatment units or landfills that receive hazardous waste after July 26, 1982. See 40 C.F.R. §§ 264.90(a)(2), 264.92. The location of the recharge wells is not premised on any waste management area. Further, since the Arsenal is being remediated pursuant to CERCLA and this IRA does not involve remediation in a surface impoundment, waste pile, land treatment unit or landfill, the section 264.94(a)(2) limits should not be ARARs.

We disagree with the chlorobenzene level because it has been derived from non-referenced sources for the protection of human health. The references do not advise the reader on the toxicological endpoints considered or the assumptions incorporated in performing the calculations for values protective of human health. Furthermore, the standard attempts to protect biota in surface water, which may not be appropriate for groundwater.

The TPES in section 129.101(a)(3) for DDT is not 10 ug/l. Shell disagrees with the TPES for this chemical because it is based on the assumption that there is not a demonstrated "no effect level." Further, EPA never had in mind the protection of groundwater when promulgating TPES, which are intended to protect surface water.

Shell questions whether 0.12 ug/l is the TPES for dieldrin. It disagrees with the ambient water criterion for aldrin/dieldrin in navigable waters based on an FDA tolerance level of 0.3 ppm for fish times an application factor of 0.01. 40 C.F.R. § 29.100(a)(3). It rejects the assumption underlying this criterion that "there is no demonstrated 'no effect level'." See 41 Fed. Reg. 23, 584 (1976). As Shell has previously explained in comments, developments in modelling, such as those by Robert Sielken, indicate that this assumption is invalid. In addition, a water quality criterion designed to provide for protection of aquatic life is not relevant and appropriate. The criterion was intended to address the impact of bioaccumulation in fish and their food sources on the biological transport of aldrin/dieldrin to birds and to mammals, including man. 41 Fed. Reg. 23,584 (1976).

Furthermore, aldrin and dieldrin are considered by the EPA CAG to be animal carcinogens and suspected human carcinogens. As stated in previous comments, numerous carcinogenicity tests in a variety of animals indicate that aldrin and dieldrin promote only liver tumors and the tumors develop only in mice. On the basis of this species-specific effect, aldrin and dieldrin are improperly categorized by the EPA as animal carcinogens.

Shell rejects the Army's proposal of 206 ug/l as an ARAR for hexachlorocyclopentadiene because it has not been adjusted for drinking water only.

The Army lists the wrong MCL for TCE; it should be 5 ug/l.

16. Page 33, 8.3.2 Location-Specific ARARs.

The Army fails to explain why it believes that the intake and other elements of public water systems, which must provide a continuous supply of safe drinking water, are similar to this IRA.

17. Page 34, (f) of second full paragraph.

(f) should be revised to conform to the language in the modified Consent Decree filed with the Court June 7, 1988. Conforming changes are also required in the last paragraph on page 34 (e.g., "physical" should be "geophysical").

18. Page 35, 8.33 Action Specific ARARs.

Shell supports the application of worker protection standards to this IRA. These standards, however, are not ARARs and should not be included in the ARAR analysis, unless language is included stating that the standards are not ARARs (as was done, for example, on page 34 with respect to paragraphs 23.2(e) and (f) of the Consent Decree).

As Shell has previously pointed out, the Colorado Ambient Air Quality Standards, Air Quality Regulation A, "Diesel-Powered Vehicle Emission Standards for Visible Pollutants," should only be considered an ARAR to the extent that motor vehicles may haul soils off-site.

Shell continues to disagree with the proposal of Colorado Air Pollution Control Commission Regulation No. 1, Section III (D)(2)(b) ("construction activities") as an ARAR for the reasons set forth in our August 1, 1988 letter on the Draft ARARs Document.

While Shell does not object to satisfaction of the Colorado Noise Abatement Statue, the statue is not an ARAR because it does not relate to a level or degree of cleanup.

Shell disagrees that all substantive requirements of parts 262, 263, and Subparts I and L of part 264 should be ARARs for materials determined to be hazardous wastes. The difference between substantive and procedural requirements is not always clear. Shell suggests that, at the time that any determination is made regarding whether the soil is a hazardous waste and that the soil cannot be placed back into the excavation, each provision of the RCRA regulations be analyzed separately to evaluate whether it should be selected as a possible ARAR.

If air stripping is selected, Colorado Air Quality Control Commission Regulation 7, Section II.D.2 should be considered as a possible ARAR.

RESPONSES TO COMMENTS SUBMITTED BY SHELL OIL COMPANY ON THE PROPOSED DECISION DOCUMENT FOR THE GROUNDWATER TREATMENT SYSTEM IN THE BASIN A NECK INTERIM RESPONSE ACTION AT ROCKY MOUNTAIN ARSENAL, SEPTEMBER 1988

1. Page 12, first paragraph.

The second bullet - "(i)mprove the efficiency and efficacy of the boundary treatment system" - should not be listed as a specific objective for the following reasons. First, this objective statement is too vague for design and implementation, e.g., what is meant by system efficiency; what boundary treatment system? Second, although a Basin A Neck intercept/treatment system may have an impact boundary systems, any impact would occur in the distant future, thus this objective is not appropriate for an interim response action. Third, neither in this document or in the Alternative Assessment document is there any discussion of how this IRA would affect boundary systems.

Response: The reduction of contaminants in the groundwater flowing from the Basin A Neck towards the boundary treatment systems is one of the significant benefits that will result from the implementation of this IRA. This result, while not measurable at the Arsenal boundary for several years, will be attained prior to the completion of the comprehensive cleanup of the Arsenal. The Army believes that this objective is among those appropriate for this IRA.

2. Page 12, fourth bullet.

This specific objective - "(h)ave a remedial effect on groundwater within RMA" - should also be deleted because it also is too vague and, in addition, is largely embraced in the first specific objective.

Response: The Army believes that this objective is different than the first listed objective, which deals with minimizing the spread of contaminated groundwater. This objective addresses the remediation that will occur through the cleanup of groundwater within the Arsenal boundaries.

3. Page 12, second paragraph.

Replace the fourth bullet with "Be consistent with and contribute to the efficient performance of Final Response Actions to the maximum extent practicable; and" to reflect the provisions of paragraph 9.5 of the Consent Decree.

Response: The text has been revised in response to this comment.

4. Page 12, second paragraph.

Replace the fifth bullet with "Use the most cost-effective alternative for attaining the objective of the IRA" to reflect the provisions of paragraph 9.6 of the consent Decree.

Response: The text has been revised in response to this comment.

5. Page 17, second full paragraph.

In the last sentence, add and chloroform after methylene chloride.

Response: The text has been revised in response to this comment.

6. Page 18, third line.

The statement, "spent carbon, if not regenerated, requires disposal as a hazardous waste," should be clarified. The spent carbon would have to be handled as a hazardous waste only if testing indicated that it was a characteristic hazardous waste.

Response: The text has been revised in response to this comment.

7. Page 20, first full paragraph.

Add to the end of the last sentence: and will not further considered.

Response: The text has been revised in response to this comment.

8. Page 23, September 1987 entry.

The relevance of this entry is not clear since the Organizations had already agreed to this IRA in June 5, 1987 filing.

Response: The entry is only meant to reflect the historical background of this IRA.

9. Page 25, first paragraph.

Delete the last two lines of this paragraph and replace with "objectives of this IRA and the criteria considered to achieve those objectives..." to ensure that there is no inconsistency between the statement on page 25 and the objectives and criteria listed on page 12.

Response: The text has been revised in response to this comment.

10. Page 25, Section 6.0.

Addition of the paragraph below after the first paragraph of 6.0 will provide useful perspective on this IRA:

> Since the purpose of this IRA is to minimize the spread of contaminated groundwater through the Basin A Neck (and thus is anticipated to contributed to the efficient performance of Final Response Actions),
>
> design goals will focus on the quantity of contaminants captured by the system, rather than on the attainment of a particular treatment water quality. Also, because the benefits of this IRA are directly dependent on the time by which this action leads the Final Response Actions, the design and Implementation Plan will emphasize timely completion and start-up."

Response: A similar paragraph has been added to provide a clearer perspective of this IRA.

11. Page 25, Section 6.1.

In the last sentence, delete the ending started with "...ability of the resulting system..." and replace with "objectives of this IRA and the criteria considered to achieve those objectives."

Response: The text has been revised in response to this comment.

12. Page 30, Section 8.1.

In the fourth and fifth lines, replace "applicable or relevant and appropriate Federal and State Standards" with the following definition of ARARs, based upon section 121(d)(2) of CERCLA: "standards, requirements, criteria, or limitations under any Federal environmental laws (or more stringent promulgated standards, requirements, criteria, or limitations under State Environmental or facility sitings) that are legally applicable to the hazardous substance or pollutant or contaminant concerned or relevant and appropriate under the circumstances of the release or threatened release."

Response: The text has been revised in response to this comment.

13. Page 30, Section 8.2.

This section should be deleted, because it was outside the agreed upon process for identification and selection of ARARs under paragraph 9.7 of the Consent Decree.

Response: This section has been expanded to more accurately reflect the background of the development of ARARs for this IRA.

14. Page 30, second paragraph of 8.3.1.

The first sentence states: "The purpose of this IRA is to reduce the level of contamination in the groundwater in Basin A Neck in order to improve the efficiency and efficacy of treatment by the RMA boundary systems and thereby to accelerate the remediation of RMA groundwater."

This statement is not consistent with the discussion under 3.0 Interim Response Action Objectives on page 12 and does not accurately capture the objective of this IRA. Moreover, neither in this document nor in the Alternatives Assessment document is there discussion of how this IRA will affect the boundary systems. Shell believes it is unlikely that this IRA can on a cost/benefit basis be justified on the basis of improved efficiency of the RMA boundary systems. The purpose of this IRA is simply to prevent enlargement of the groundwater contamination problem during the five or more years before the Final Response Action for the On-post Operable Unit will be implemented. This purpose is adequately reflected in the first specific objective listed on page 12.

Response: This section has been revised.

15. Page 30, 8.3.1, Ambient or chemical-Specific ARARs.

In light of the appropriate purposes for this IRA set forth in comment #14 above, health-based concentration levels should not be considered as ARARs, because no humans will drink the treated groundwater until further treatment at the existing boundary systems or at other future systems that may become part of the remedy. For this reason, the discussion under 8.3.1 and the standards should be deleted because they are health-based. Shell sets forth below additional reasons for deleting the proposed "ambient or chemical-specific" ARARs.

The levels based on the National Primary Drinking Water Standards or MCLs are particularly not relevant and appropriate because they are intended to be protective of water at the tap used for drinking. See arsenic, benzene, carbon tetrachloride, chloroform, 1,2-dichloroethene, 1-1-dichloroethylene, endrin, mercury, 1,1,1-trichloroethane, and trichloroethylene.

Shell further disagrees with the selection of the maximum concentration of constituents in Table 1 of 40 C.F.R. (264.94 for groundwater protection as ARARs, including ones for arsenic and mercury. These standards are intended to apply at the boundary of a waste management area and to

trigger corrective action for surface impoundments, waste piles and land treatment units or landfills that receive hazardous waste after July 26, 1982. See 40 C.F.R. ((264.90(a)(2), 264.92. The location of the recharge wells is not premised on any waste management area. Further, since the Arsenal is being remediated pursuant to CERCLA and this IRA does not involve remediation in a surface impoundment, waste pile, land treatment unit or landfill, the section 264.94(a)(2 limits should not be ARARs.

We disagree with the chlorobenzene level because it has been derived from non-references sources for the protection of human health. The references do not advise the reader on the toxicological endpoints considered or the assumptions incorporated in performing the calculations for values protective of human health. Furthermore, the standard attempts to protect biota in surface water, which may not be appropriate for groundwater.

The TPES in section 129.101(a)(3) for DDT is not 10 ug/1. Shell disagrees with the TPES for this chemical because it it based on the assumption that there is not a demonstrated "no effect level." Further, EPA never had in mind the protection of groundwater when promulgating TPES, which are intended to protect surface water.

Shell questions whether 0.12 ug/1 is the TPES for dieldrin. It disagrees with the ambient water criterion for aldrin/dieldrin in navigable waters based on an FDA tolerance level of 0.3 ppm for fish times an application factor of 0.01. 40 C.F.R. (29.100(a)(3). It rejects the assumption underlying this criterion that "there is no demonstrated 'no effect level'." See 41 Fed. Reg. 23, 584 (1976). As Shell has previously explained in comments, developments in modelling, such as those by Robert Sielken, indicate that this assumption is invalid. In addition, a water quality criterion designed to provide for protection of aquatic life is not relevant and appropriate. The criterion was intended to address the impact of bioaccumulation in fish and their food sources on the biological transport of aldrin/dieldrin to birds and to mammals, including man. 41 Fed. Reg. 23,584 (1976).

Furthermore, aldrin and dieldrin are considered by the EPA CAG to be animal carcinogens and suspected human carcinogens. As stated in previous comments, numerous carcinogenicity tests in a variety of animals indicate that aldrin and dieldrin are improperly categorized by the EPA as animal carcinogens.

Shell rejects the Army's proposal of 206 ug/1 as an ARAR for hexahlorocyclopentadiene because it has not been adjusted for drinking ater only.

The Army lists the wrong MCL for TCE; it should be 5 ug/l.

Response: The Army determined that the standards listed in Section 8.3.1 as chemical-specific ARARs were not applicable to this IRA because the contemplated system was not a public water system and did not provide drinking water to individuals. However, these standards were determined to be relevant and appropriate to apply at the point of reinjection of the treated water. In general, the Army considered the potential for human exposure over the long-term, the fact that treated water would potentially be available at some future date for a variety of uses, the fact that treated water would at some time flow beyond boundaries under Army control, the ability to achieve standards while maintaining appropriate speed in establishing the IRA, the benefit to the boundary treatment systems of a reduced contaminant loading in the future and that potential effect on final remediation, and similar considerations. In reviewing these concerns, the Army determined that the listed standards were relevant and appropriate under the circumstances to apply to this IRA, although there is no known current human exposure to this water as drinking water.

Several of Shell's comments address the methodology used by EPA to establish particular standards for compounds, such as the CAG methodology. Shell is in the process of presenting some of its concerns in this area and some of its recently developed data to EPA for their consideration. EPA, as the primary technical agency in this area for the United States, determines the appropriate methodology and standards to utilize when developing criteria for compounds. The Army accepts the standards set by EPA for specific compounds and attempts to apply them in particular interim actions in accordance with current guidance.

Shell is incorrect in their comment concerning TCE. The standard is correctly stated in the document.

The Army has revised Section 8.3.1 based upon some of the general concerns raised by Shell in this comment.

16. Page 33, 8.3.2 Location-Specific ARARs.

The Army fails to explain why it believes that the intake and other elements of public water systems, which must provide a continuous supply of safe drinking water, are similar to this IRA.

Response: The Army has determined that it is relevant and appropriate to apply the siting requirements for public water systems to this interim action. While the Basin A Neck system will not be a supplier of drinking water, the focus of these siting requirements is to ensure such systems are constructed in areas where they are not subject to unreasonable risk from certain geological or physical events. This system is similar to a drinking water supply system in that it pumps groundwater, treats it and has certain similar construction. It is an expensive undertaking to install this system and it is considered important to the RMA comprehensive cleanup program. In

considering these factors, the Army concluded that these siting requirements were relevant and appropriate to apply in the context of this IRA.

17. Page 34, (f) of second full paragraph.

(f) should be revised to conform to the language in the modified Consent Decree filed with the Court June 7, 1988. Conforming changes are also required in the last paragraph on page 34 (e.g., "physical" should be "geophysical").

Response: The text is correct in the document.

18. Page 35, 8.33 Action Specific ARARs.

Shell supports the application of worker protection standards to this IRA. These standards, however, are not ARARs and should not be included in the ARAR analysis, unless language is included stating that the standards are not ARARs (as was done, for example, on page 34 with respect to paragraph 23.2(e) and (f) of the Consent Decree).

As Shell has previously pointed out, the Colorado Ambient Air Quality Standards, Air Quality Regulation A, "Diesel-Powered Vehicle Emission Standards for Visual Pollutants," should only be considered an ARAR to the extent that motor vehicles may haul soils off-site.

Shell continues to disagree with the proposal of Colorado Air Pollution Control Commission Regulation No. 1, Section III (D)(2)(b) ("construction activities") as an ARAR for the reasons set forth in our August 1, 1988 letter on the Draft ARARs Document.

While Shell does not object to satisfaction of the Colorado Noise Abatement Statue, the statue is not an ARAR because it does not relate to a level or degree of cleanup.

Shell disagrees that all substantive requirements of parts 262, 263, and Subparts I and L of part 264 should be ARARs for materials determined to be hazardous wastes. The difference between substantive and procedural requirements is not always clear. Shell suggests that, at the time that any determination is made regarding whether the soil is a hazardous waste and that the soil cannot be placed back into the excavation, each provision of the RCRA regulations be analyzed separately to evaluate whether it should be selected as a possible ARAR.

If air stripping is selected, Colorado Air Quality Control Commission Regulation 7, Section II.D.2. should be considered as a possible ARAR.

Response: The Army believes that worker protection standards should be considered as ARARs, particularly in view of the direct reference to such standards in CERCLA.

The Army considers the Colorado standards concerning diesel powered vehicle emissions an ARAR only to the extent that such vehicles haul soils off-site.

The Army considers Colorado Air Pollution Control Commission Regulation No. 1, Section III (D)(2)(b) as relevant and appropriate to apply to this IRA to provide protection for air quality during construction. The noise standard cited is specificall applicable to construction activities.

While it may be difficult at times to distinguish between substantive and procedural requirements of RCRA, this is no more difficult than many other aspects of administering the cleanup program for RMA. The Army does not believe that there is a significant difference between the approach suggested by Shell and the approach intended by the Army in addressing hazardous wastes. As stated in the Proposed Decision Document, the specific substantive standards to be applied will be determined by the factual circumstances of the accumulation, storage or disposal techniques actually applied to such material.

If air stripping is used, further potential ARARs will be considered.